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ABSTRACT

Specialized price indexes and supporting price data for elementary, secondary, and higher education institutions are presented. The indexes can be used to deflate revenues and expenditures to obtain dollars of constant purchasing power. The School Price Index (SPI), a new index for fiscal years 1975-1982, prices the goods and services purchased by elementary-secondary schools for their current expenses. The Higher Education Price Index (HEPI), which covers 1961-1982, measures changes in the prices of goods and services purchased by colleges and universities, excluding research. Items priced by the SPI and the HEPI include: teaching, administrative, clerical, and other staff; contracted services; supplies and equipment; books and periodicals; and utilities. A Research and Development Price Index prices current direct expenditures by universities for sponsored research and development, excluding expenditures for expensive scientific equipment. In addition, attention is directed to: the need for specialized indexes for education and their uses; the theory and computation of price indexes; historical effects of inflation; college physical plant additions price indexes, student tuition price indexes for 1961-1982; and economies of scale and marginal costs analysis. (SW)

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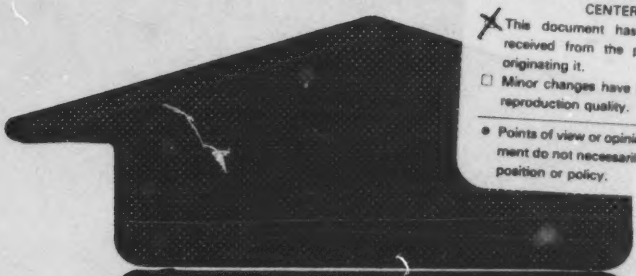

Inflation Measures for Schools and Colleges

D. Kent Halstead

August, 1983

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FOREWORD

Education, like other public services, has experienced and continues to experience the simultaneous pressures of an inflation rate that weakens the purchasing power of resources, a leveling of the economy that decreases the potential for major increases in revenues, and a demand to improve quality. Educational institutions thus face the task of attempting to enhance educational quality with real resources that, at best, will be stable and, in many instances, will be declining.

In approaching this task, institutions can benefit from an index that can be used to adjust nominal figures to constant dollar values so as to compare real resource levels over time. Although the Consumer Price Index is readily available and, for lack of a more appropriate index, has been used to deflate education dollar figures, the CPI does not measure price changes for the goods and services purchased by schools and colleges.

For a number of years, the postsecondary community has used the Higher Education Price Index, developed by Kent Halstead, to accurately adjust dollar figures to a constant dollar basis. This volume introduces the School Price Index, which can be used to deflate elementary-secondary education dollar figures. This new index constitutes a much-needed contribution to K-12 education finance analysis by enabling accurate comparisons over time on a sound dollar basis.

While price deflators for both levels of education will help to make multiyear education dollar comparisons more valid, they cannot, by themselves, mitigate the challenge to education to improve quality and become more efficient in a fiscal steady state. It remains for the education community to convincingly propose real financial requirements using these instruments of analysis, while continuing to practice operational economy.

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Director of Policy Analysis
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FOREWORD*

The National Commission on the Financing of Postsecondary Education has recommended that indicators be developed for assessing the comparative financial health of educational institutions. Kent Halstead's study belongs to a growing body of literature that is responding to the Commission's recommendations.

The Commission and others have noted that few if any current measures of inflation in higher education exist, and that no single Government or private agency maintains the sort of statistical indicators we take for granted in the measurement of economic and business performance. Why are special indicators needed to measure the financial health of colleges and universities? Why must specialized indicators of inflation be developed?

Higher education is a service industry. A key element of service occupations is that they are labor-intensive in their method of production, and as a result, the rate of productivity improvement often is slow or nonexistent. Although the economics of service industries has been given considerable attention, our national economic policy is generally derived from theories or notions that center on manufacturing. Thus, the task of measuring productivity in higher education is a special and relatively untouched problem involving qualitative and quantitative changes in human input and output.

Another special problem is our understanding of what should be the economics of nonprofit organizations. Although postsecondary education counts among its members proprietary profit-seeking institutions, higher education as a whole is a nonprofit industry whose objectives to this date have not been defined in generally accepted quantitative terms. Furthermore, there still reigns some confusion and disagreement on what the objectives of education should be.

Finally, the methods of financing higher education differ significantly from those of commercial enterprises. The structure of expenditures also differs markedly from those encountered in industry and business. Thus, the financing of colleges and universities, both on the side of revenues and expenditures, requires specialized nomenclatures.

One key finding of all recent higher education inflation studies is that colleges and universities have experienced considerably more erosion of purchasing power than has the general consumer. Although this is not surprising to insiders, the public has some difficulty assimilating this

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fact. The reason lies in the composition of the institutional market basket, which differs substantially from the purchases of the average family. The absence of an official and credible measure of inflation in higher education makes it difficult to argue this point convincingly.

Furthermore, the lack of an individual price index has affected adversely the design of state and Federal policy for higher education. Among other things, the underestimation of inflation has tended to lead to underfinancing. It is only recently that state and Federal agencies have begun to realize that despite ever-increasing appropriations and program expansion, little improvement has been made in the real resources expended per student.

Dr. Halstead refers early in his study to some other path-breaking efforts. If anything, he understates the urgency that has been manifesting itself all around. During the last 2 years alone, a wealth of unpublished work has been done by college administrators in connection with budget and long-range planning, and by graduate students in more theoretical studies. State planning and coordinating agencies also have done extensive professional work in trying to come to grips with the problem of inflation in higher education.

Those of us who have toiled in this particular vineyard share a sort of double vision. On the one hand, we are pleased that others around us have taken up the challenge and are pushing forward both the methodology and our understanding of how inflation has been affecting higher education. At the same time, we are struck by a common sense of disappointment at the transient and unofficial character of most of these independent efforts. Some public policymakers have criticized sharply the higher education community for not producing enough useful information that would help to formulate appropriate public policy. Maybe the Halstead study can help convince these individuals that the measurement of higher education inflation is an important enough task for ongoing, permanent, and official monitoring by a public agency. The time for ad hoc studies is surely past—the moment for implementing the recommendations made by the National Commission on the Financing of Postsecondary Education is at hand. If Dr. Halstead's effort can speed this action, it will have served higher education well.

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Vice President for Finance and Business
The College of Wooster
Wooster, Ohio

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*Reprinted from *Higher Education Prices and Price Indexes*, 1975.

PREFACE

In 1975 the U.S. Office of Education published *Higher Education Prices and Price Indexes.* This landmark study was the first to introduce price indexes designed specifically for use by colleges and universities to measure inflation in their current operations and sponsored research. In the following years the new indexes gained increasing acceptance by the higher education community and are currently recognized as legitimate and essential tools for economic analyses.

Publication of this revision of *Higher Education Prices and Price Indexes* is prompted by a number of considerations. Foremost has been the development of an Elementary-Secondary School Price Index (SPI), whose introduction and description require a comprehensive and statistical treatment provided only by a complete study. Second, increased use of the Higher Education Price Index (HEPI) by colleges and universities has resulted in new demand for the original supporting material, now out-of-print. Third, a number of mechanical improvements in index data compilation are incorporated in the new revision, plus brief discussion of the phenomenon of inflation, economies of scale, and guides for budget preparation. A recapitulation of 20 years of price data (1961 through 1982) is presented. Finally, the extensive distribution of *Inflation Measures for Schools and Colleges* serves to alert the education community to the existence and value of price indexes as a useful and necessary instrument in responding to inflation.

Kent Halstead

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I. INFLATION AND EDUCATION

In the last 3 years, the economy has experienced a new and persistent phenomenon — double digit inflation. Continued inflation at 10 percent per year means that, in a decade, prices will be two and a half times their present levels. And a dollar will be worth 40 cents.

This is not speculation. It is a likely reality brought about by shortages in world resources, greater consumption of services, demand for higher living standards, and increased foreign competition, which together create an inflation beyond the reach of fiscal and monetary controls. Already many people are beginning to accept substantial inflation as a way of life. But whether pessimistic or optimistic about future inflation, an effective response is an undeniable necessity.

Both the producers and consumers of education are seriously affected by inflation. When schools and colleges pay higher prices for the goods and services of education, they must secure additional revenues if programs and faculty are to be maintained at existing levels. New revenues from higher tuition can be realized for students only if their job earnings or parental contributions also increase.

The Need for Specialized Price Indexes

To preserve the purchasing power of students and institutions, it is first necessary to measure the rate of inflation. Such a measurement — a price index — has been available to the citizen consumer for years. The Consumer Price Index (CPI) reports changes in prices paid for food, clothing, shelter, transportation, and the other goods and services that people buy for day-to-day living. Obviously, such an index is not appropriate for industry and for commercial and business enterprises that buy substantially different sets of goods and services involving different price changes or inflation rates. In fact each industry is sufficiently unique to require its own measure of inflation.

The need for specialized price indexes has only recently been recognized by educators. The first compilations were made as a one-time effort by individuals with limited sponsorship.[1] To initiate a more substantial and sustained effort, the author in 1963 submitted to the U.S. Office

[1] A major contribution that includes an early survey of price index compilations (pp. 110-127) is contained in William Wasserman, *Education Price and Quantity Indexes*, Syracuse University Press, Syracuse, N.Y., 1963.

of Education a paper titled "An Introduction to the Technique of Developing a Higher Education Price Index." There was little response, but it must be remembered that inflation at that time was a scant 3 to 4 percent.

Two studies in the early seventies showed continued use of and interest in price indexes for higher education;[2] however, neither study established a consistent means for reporting price data. In 1975, however, such a system was established by the U.S. Office of Education beginning with publication of *Higher Education Prices and Price Indexes,*[3] which reported price indexes for colleges and universities back to 1961. The Higher Education Price Index (HEPI), introduced at that time, has subsequently been reported yearly, first in *Supplements* (1975 through 1978), then in the National Association of College and University Business Officers *Business Officer* (1979 and 1980), and currently by a private research firm.[4]

Of recent importance is the work of George Baughman in creating a computerized system for generating an academic research price index. Baughman's University Price Index Calculation System (UPICS) uses detailed year-end accounting expenditure records of universities to calculate the weighted "market basket" of inputs for research or for any other higher education activity.[5] UPICS has also created a data bank of published official and unofficial price relatives, reported on a fiscal year basis, showing price changes over time. The computerization of this massive amount of data provides the speed and flexibility required for the multiple uses of weighting and price data.

It was not until the past year that an elementary-secondary school price index was developed. As early as 1960, Dr. Orlando F. Furno developed and published a "Cost of Education Index" in *The School Management* magazine. Furno's work continued to be published through 1977-78 in the yearly *National Comparison Local School Costs* study.[6]

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[2]June O'Neill, *Resource Use in Higher Education,* Carnegie Commission on Higher Education, Berkeley, Calif., 1971 (see Appendix B: "Price Indexes for Instructional Operating Expenditures"); and G. Richard Wynn, *Inflation Indicators in Liberal Arts Colleges,* available from Xerox University Microfilms (Order No. 75-1399), P.O. Box 1307, Ann Arbor, Mich. 48106. Also reported by Wynn in "Inflation in the Higher Education Industry," *Professional File,* Vol. 6, No. 1, January 1975, National Association of College and University Business Officers, One Dupont Circle, Washington, D.C. 20036.

[3]Kent Halstead, *Higher Education Prices and Price Indexes,* Office of Education, U.S. Department of Health, Education, and Welfare, 1975.

[4]Yearly updates of the HEPI are published in August-September. Annual subscription is $35. Research Associates of Washington, 2605 Klingle Rd. N.W., Washington, D.C. 20008.

[5]K. Scott Hughes, "University Price Index Calculation System: A Study of Inflation Indicators for Research Universities," *Business Officer,* April 1979, pp. 21-23, National Association of College and University Business Officers, Washington, D.C.

[6]*National Comparison Local School Costs* published yearly in three volumes, $295. Discontinued after 1977-78 edition. Market Data Retrieval, Inc., Ketchum Place, Westport, Conn.

The data consist of per-pupil expenditures and related averages in standard budget categories in school districts, classified separately by geographic region and size of school district. These data are extremely useful as yardsticks against which individual school districts can compare their own expenditures. However, the data did not constitute a true price index in the sense that price change and only price change is measured.

The Elementary-Secondary School Price Index (SPI), developed by this author, is introduced and explained in chapter VII of this study. The chapter begins with a presentation on the effects of inflation on school current expenses using the new index to illustrate the methodology and value of a price index in the economic analysis of school financing. Subsequent sections of the chapter explain the components of the index and their respective weightings, followed by descriptions of the various price series used for the goods and services comprising the school market basket.

The remainder of this introductory chapter is focused on the national phenomenon of inflation—its history and persistent causes—on the impact of inflation on educational institutions, and on institutional responses. An underlying theme throughout the chapter is that despite our knowledge and understanding of inflation and its effect on institutional financing, we cannot deal with inflation effectively unless we first measured it accurately.

Inflation—Historical Perspective

There is a paradox in the United States today—recent inflation can be viewed as abnormally high, yet also as a normal expectation. This inconsistency occurs because of the overlap of two unique periods in our history. Looking at the past we observe with Arthur Burns that, from a historical standpoint, "Nothing is normal about high inflation." Yet looking into the future, we are likely to conclude with economist S. Jay Levy that rapid price increases may be here to stay.

In 1980 and 1981, education in the United States experienced the highest inflation in history, 10 percent. In the early 1960's it was less than 4 percent. It would be nice to believe that the current extreme is only temporary. Yet recent headlines refer to our economy's "nagging inflation," or "deep intractable inflation." The view that educators take toward future inflation will, in large measure, determine their preparedness to respond effectively.

To gain perspective on future inflation, it is helpful first to understand how abnormal today's price changes are from a historical standpoint and how serious inflation got started in this country. Most important, if educators are to gauge future inflation accurately, they must know the current new causes of price increases and why these factors are likely to persist and be immune from government redress.

It is of little consolation to know that the price level in England around the year 1500 was about the same as in the 1260's. Over the 240-year period, the average level of consumer prices fluctuated from year to year in response to wars, variations in harvests, acts of government, and civil disorders. Yet the underlying trend of the price level was sideways; that is, general price increases were soon followed by decreases—they did not cumulate. The trend of the price level in England continued to be horizontal over the century from 1650 to 1750.

In our own country, the underlying trend of the price level also moved sideways over a long period. To be sure, from the 1780's to the 1930's prices were in a state of flux. But the upward movements, whether occasioned by wars or economic developments, were always followed by downward movements of a similar order of magnitude. Thus we managed to avoid persistent, cumulative declines in the purchasing power of the dollar.

A new and momentous chapter in the history of prices began in the 1930's. In the century and a half prior to 1939, measures of both the wholesale and consumer price levels moved down in about as many years as they moved up. But in the 42-year stretch since then, the consumer price level has risen in 40 of those years and the wholesale price level in 37 years. The consumer price index has risen steadily since 1955. Such an unbroken string of price increases is without precedent in American history.

This persistent recent advance in prices has three distinctive features.

- First, it has had limited regard for the business cycle. In the past, prices generally rose during expansions and fell during contractions of overall business activity. The last time that prices behaved in this fashion was during the recession of 1948-49. During the six recessions that have occurred since then, the price level has actually risen in each instance and the rate of increase has tended to be higher in successive recessions.
- Second, the major inflation brought on by World War II was not followed by a major deflation, as had been the case after every other major war. Indeed, this was the earliest clear signal that a new era in the behavior of prices was underway.
- Third, prices have advanced with unprecedented rapidity. In 1979 the consumer price level was more than five times what it had been in 1939. There has been no other 40-year period since the Revolutionary War when advances in the price level even remotely approached this pace.

How did this great inflation of our times get started and gather strength? The fundamental cause was the philosophical and political currents that were released in our country and elsewhere by the Great Depression of the 1930's, then by World War II, and later still by the response of a Great Society to public needs. A breakdown of economic order occurred during the early 1930's. As a result, a radically novel idea

began to spread and soon dominated economic thinking—that the Federal Government had a basic responsibility for mitigating depressions and promoting economic stability. In 1933 President Roosevelt ushered in the New Deal, with the Government becoming a significant factor in the nation's economic life.

The outbreak of World War II further enhanced the Government's economic role. Just as most Americans had been persuaded during the Depression that the Federal Government could mitigate the hardships caused by unemployment and falling incomes, so they were persuaded by the high employment and rising overall output of consumer goods and services during World War II that the Government could prevent substantial increases in unemployment.

In response to these expectations, the Congress passed the Employment Act of 1946, which declared that "it is the continuing policy and responsibility of the Federal Government to promote maximum employment, production and purchasing power." This act has since been the Magna Carta of the nation's economic policy.

The Federal Government's assumption of responsibility for maintaining prosperity not only diminished fears of unemployment, it also fostered expectations of steady improvement in living standards. Generally prosperous conditions developed between the end of World War II and the mid-1960's. But neither the general advance of prosperity nor the rising tide of economic and social legislation kept pace with the rising expectations of the American public. For a time, the resistance of the Eisenhower administration to social activism succeeded in checking the inflationary bias that by then had emerged in our economy. But this resistance also led to social and political discontent that later exploded in the Great Society programs of the 1960's. Besides fighting a war in Vietnam, our Government then boldly undertook to eliminate the poverty still in our midst, to assure safety in our workshops, to improve schooling at every educational level, to revolutionize medical care, to cleanse our air and streams and otherwise improve the environment—in fact, to try to solve almost every economic and social problem by spending more public money, raising taxes, stepping up its own borrowing, fostering liberal credit facilities for private borrowers, and imposing a maze of costly regulations on private industry.

That, in brief, is how the great inflation of our times got started. Unfortunately, it is not the basic reason for its continuation in the future. If it were only that simple, then Government fiscal and monetary restraint might stem the tide.

The New, Persistent Causes of Inflation

In attempting to deal with inflation, it is important to recognize that deep intractable inflation may be an enduring phenomenon of our times,

a fault of our numbers and habits of life, which are not about to be changed by congressional budget committees or tight-money policies of the Federal Reserve. The initial causes of inflation—deficit spending, low interest rates, large money supply (the usual litany of Keynesian governmental actions)—are now mere phantom reasons for today's spiraling prices. Our troubles stem from four new, relatively permanent factors over which the Government has little or no control.

First, there is the stunning change from a world of abundance to a world running out of natural resources. Beginning in the late 1960's, the prices of cocoa, copper, corn, cotton, lead, silver, and other basic commodities soared, followed in 1974 by oil and sugar. Nature is not infinitely bountiful and no economic policy can compensate for the shortage.

Oil from Alaska is more expensive than oil from Texas. Silver from the poorer ores of worked-over mines is more expensive than silver from newly opened lodes. We used to import 10,000 pounds of coffee for the equivalent price of one automobile. Now, worldwide demand has pushed the price up to two automobiles—twice the manpower and equipment spent for the same amount of coffee.

We used to invest in technology that would provide more products at lower costs. Now we invest in technology that provides products at higher costs, because that's the only way to get them at all.

The second cause of our inflation is the kind of buying decisions that families make today. We are buying more services that require detailed personal attention and do not lend themselves to mass production techniques. Mass production is one of the keys to a higher standard of living. If workers earn more money and at the same time increase the amount of goods or services they produce, there is no inflation and the workers come out ahead. But the growing service economy—now about half of our personal consumption expenditures—cannot easily be made more efficient.

Working wives are responsible for much of the growth in the service economy. In many families, a husband's income buys the basic household goods—the car, the television, the washing machine—and the second income goes for services like restaurant meals, college education, and vacations. As long as we choose to buy more services, gains in national productivity will remain low and high wage gains inflationary.

The third and most serious cause of inflation is the novel class war developing in America. Low productivity and natural resource shortages ensure an underlying inflation rate of 4 to 5 percent, which translates into a lower standard of living for the average American. But no one wants to accept that. So each group tries to grab an income advantage at the expense of others. Their competition produces money gains but makes inflation worse.

During most of the 1970's, wages and salaries rose faster than prices, putting employees ahead of inflation but at the expense of people living on savings and investments. Since the mid-1970's, retirees have struck

back through indexed social security, and they are now agitating for indexed private pensions. This class war is worsened by the growing number of nonworkers. In the 1970's, the general population grew 8 percent, the working population, 24 percent, and the retired population, 50 percent. This meant that fewer people were producing and more people consuming. The percentage of retirees will grow in the 1980's, which will put even more inflationary pressure on the amount of goods and services available for sale.

A fourth contributor to inflation is increased foreign trade. Because of effective competition and lack of productivity in some areas, we have been relying more and more on foreign trade. Just 10 years ago, the United States was importing very little oil. Now half our oil comes from overseas. We also import a lot of automobiles, and Sweden and Japan are making some of our steel. The import-export deficit has decreased the value of our dollar in comparison with other industrialized nations. Since we have established a willingness to buy their products—a demand—they feel free to raise their prices. When the products we are buying from them become more expensive, our dollars become "cheaper" and inflation gets worse.

There are two other persistent secondary causes of inflation over which the Federal Government can exercise some control. First, much current inflation is fueled on credit. Americans owe $150 billion in commercial bank loans, $115 billion in car loans, and $29 billion on bank credit cards. Credit cards have ballooned consumer debts to a level well above half the size of the Federal budget and helped reduce private saving to a historic low. The general message is buy now before it costs more. Incontinent private credit is spurred by inflation rates guaranteeing that you can beat the usury man every time. However, the expansion of private credit feeds, as it is fed, by inflation, distancing aggregate demand from the reach of fiscal and monetary tools on which Government formerly relied.

Second, new, more stringent Government regulations have contributed to inflation. Zoning regulations can increase the cost of a new house by specifying that it must have certain dimensions, be on a certain size lot, or be constructed with special water or sewer systems. Environmental and safety regulations affect prices. Automobile manufacturers frequently complain that they are forced to raise the price of their products to absorb the cost of plant safety because of safety requirements set by the Government. Companies that are forced by environmental rules to treat chemical waste before disposal have to spend extra money to get this done. The consumer eventually pays the cost.

A long list of remedial actions has been proposed by the present and previous administrations—balance the budget, curb growth in the money supply, reduce burdensome and costly regulations and those that stifle competition, provide tax incentives to companies to modernize and improve production, establish selective credit controls to encourage

restraints and prudence, encourage consumers to spend less on inflationary items, reduce taxes to spur private investment and productivity, add excise taxes on gasoline to cut energy consumption, levy wage and price controls, phase decontrol of oil prices to allow U.S. prices to rise to the world level and thereby reduce energy consumption.

But for many economists and other observers, the basic unalterable facts of continuing decline in world resources, increased consumption of services, struggle to maintain standard of living, and increased foreign trade suggest the continuing long-term presence of serious inflation in this country.

Impact of Inflation on Educational Institutions

What has been the impact of inflation on colleges and universities?[7] Many institutions experienced a series of budgets that were mostly, if very narrowly, in surplus during the 1960's. A simultaneous slowing down of the rate of growth of several major sources of income led to deficits in the 1970's. What is troubling is not so much the size of the cumulative deficit but the fact that this financial result has come after, and in spite of, a series of extremely painful decisions concerning both expenditures and charges. Inevitably these decisions have affected every aspect of the life of the institution, and it is the combination of financial and educational consequences that should concern us.

From the standpoint of the long-term financial difficulties common to all of higher education, the central economic fact of life is the very nature of the processes of education and scholarship. To be done well, particularly at advanced levels, education requires personal attention and personal interaction that simply do not allow the same opportunities for technological change, mechanization, and increases in "output per unit of labor input" that characterize the production of feed grains and calculators. As a result, we must expect the costs and prices of educational services, particularly when faculties are fairly compensated, to rise more rapidly than prices in general.

But it is not inflation alone that has hurt institutions. Rather, it is the combination of a degree of inflation and a substantial amount of unemployment, with attendant declines in real income. Every source of income available to colleges has been affected by the recent slump in output, employment, and profits. The burden of tuition, for example, is much harder for students and parents to bear in the face of unemployment and reduced real incomes. State budgets, and thus appropriations for higher education, have been affected adversely by the general fiscal problems of the country. Between fiscal 1980 and 1982, state and local

[7]The effect of inflation on elementary-secondary schools is limited to the post-1975 period for which the School Price Index is available.

government appropriations per student in constant dollars decreased in 33 states.

In summary, the impact of the recent inflation has been exceptionally serious because it has not been accompanied by any of the offsets that might be anticipated, such as rapid increases in money incomes, rising securities prices, and significant increases in the revenues received by the Federal and state governments. Such developments have made it somewhat easier to accept rising levels of student charges, to increase income from endowment and from gifts, and to anticipate at least modest help in the form of increased governmental appropriations. The absence of these offsets, and the presence in so many instances of their obverse, has made this an extraordinarily difficult and threatening period for all of higher education.

Institutional Response to Inflation

In the face of continuing serious inflation, what measures are available to assist schools and colleges to maintain financial strength and stability? The essential theory in formulating aggregate budgets, taking inflation into account, is suggested by five key actions — interpret, project, charge, economize, and report. With license for rearrangement, the steps can be recalled by the acronym PRICE.

The first step is to INTERPRET the impact of inflation on institutional financing by comparing past expenditures and revenues with movements in a related price index to see whether they have kept pace with price changes and maintained purchasing power. This is accomplished by dividing the expenditure or revenue amounts by the appropriate price index and unit of need/use to obtain a trend in constant dollars per using element.

Starting on an aggregate basis, the "student education" expenditures of colleges and universities (instruction, academic support, libraries, institutional support, student services, and operation and maintenance of the plant) could be deflated using the Higher Education Price Index. For example, suppose a college enrolling 7,530 students in 1974 with an annual student education budget of $20.8 million nearly doubled its revenues to $40.6 million in 1981 with an increase of only 1,400 students. This is remarkable growth, but aggregate dollars are misleading. With inflation averaging 8 percent a year during this period, the institution actually *lost* purchasing power—from $4,761 per student in 1974 to $4,546 per student in constant (1981) dollars 7 years later [$20.8 million/7,530 students × (263.9 HEPI 1981/153.1 HEPI 1974) compared to $40.6 million/8,930 students].

This example is not hypothetical. Add three zeros to enrollment and to revenues, and you have the national totals. Thus, U.S. colleges and universities had $215 dollars per student (1981 dollars) less purchasing

power in 1981 than in 1974, a loss in 1981 of $1.92 billion ($215 per student × 8,930,000 students). This loss may have caused some deterioration in the quality of education being provided, curtailed certain programs, necessitated greater operating economy and efficiency, or caused some combination of these actions that would permit lower unit operating expenditures.

Similar trend analysis of specific expenditures can be made using related price deflators and user units (e.g., expenditures for research per faculty member deflated by the R&DPI, expenditures for library acquisitions per student deflated by the library price series of the HEPI).

Analysis of institutional financing should extend to deflating dollar incomes to identify trends in funding from different sources in terms of their level of real purchasing power. For example, tuition charges or state appropriations used for education and general purposes by colleges and universities may be deflated by the HEPI to determine the extent that income from these sources has increased to offset the effects of inflation on institutional buying power. Specialized subindexes may be used to deflate either incomes or expenditures used for particular purposes. Thus, endowment income restricted for new library volumes could be converted to constant purchasing power by using the price series for books and periodicals. The new acquisition budget could be deflated in the same manner.

The second step is to PROJECT interpreted financial data to the year for which funding is sought, generally a 1- or 2-year advance. Essentially the process consists of projecting enrollments, per-student expenditure requirements, and inflation, and then converting the derived budget from constant to actual dollars. In summary form, the five computations required are as follows:

1. Project enrollment growth (decline) in FTE students and determine the change in enrollment for the projected interval.
2. Multiply the enrollment change by present marginal costs per student to derive the change in funding required. Add the change in funding to the present year's budget to equal the projected total budget. (Note: Determination of marginal costs is presented in Appendix A.)
3. Increase the projected total budget by a "quality" factor (e.g., 2 to 5 percent) to account for new equipment requirements, reduction in class sizes, establishment of faculty chaired positions, reestablishment of maintenance programs previously deferred, and improvements in institutional quality requiring funding beyond standard requirements.
4. Adjust the projected budget (in constant dollars representing required real purchasing power) to actual dollar funding requirements by inflating per a projected HEPI. Thus, if inflation is expected to be 20 percent over the projection period, the projected budget must be expanded by 20 percent. The volatile pattern of in-

creases in the HEPI prevents easy trend projection. Projection on the basis of a 3- or 4-year average can be considered reasonable.

5. Determine the proportion of the projected budget to be provided by each funding source, taking account of trends in the ratios of support from each source.

The third step is to adjust student CHARGES (tuition). There are five related bases from which to select tuition adjustment policy. Selection will depend on institutional philosophy regarding student versus public returns and responsibility for payment, preservation of competitive position, and urgency in maximizing revenues. Tuition increases are maximized by using the base with the greatest growth rate.

1. Tuition may be tied to institutional inflation, i.e., increased equal to the increase in prices affecting institutional purchases as measured by the HEPI (national rate of 9.9 percent, FY 1979 to FY 1980).
2. Tuition may match the increase in actual institutional student-related costs. Actual per student cost increases will be larger than the inflation rate if a substantial attempt is being made to upgrade faculty and administrator salaries relative to all other institutions and otherwise improve institutional quality by purchasing better equipment, reducing class size, etc. (national rate of 9.5 percent, FY 1979 to FY 1980).
3. Tuition may be set to provide a constant proportion of education *revenues* per student (national rate of approximately 9.5 percent, FY 1979 to FY 1980).
4. Tuition may be set relative to ability to pay, i.e., in some consistent relationship to family income or family disposable income (national rate of 6.9 percent, FY 1979 to FY 1980).
5. Tuition may match inflation in the general economy as measured by the Consumer Price Index, i.e. the student consumer pays a higher tuition equal to the price increases of other goods and services purchased (national rate of 13.3 percent, FY 1979 to FY 1980).

The fourth step, ECONOMIZE, urges the effective and efficient use of all resources. As accountable public service institutions, colleges and universities must demonstrate efficient use of the limited resources provided by government, philanthropy, students, and industry. In fact, acceptance of all budget increases is based on the premise that funds have been, currently are, and will be spent in the most efficient manner possible.

The fifth step, REPORT, involves effectively communicating the rationale and actions of the first four steps to the institution's funding sources to elicit responsible support. As a result of separately identifying budget increases for program expansion, quality improvement, and inflation in the second step ("project"), a separate, persuasive argument can be made for each type of requirement. And since funding organizations usually have different criteria for supporting the three types of

financial requirements, this separation materially assists in properly aligning budget components with associated funding action.

Explanation and Use of Price Indexes*

A price index measures the effect of price change, and price change only, on a fixed group of consumer items. The change in price index values from year to year may be interpreted as the change in resources required to offset the effects of inflation in buying the same kinds and amounts of goods and services previously purchased. For example, if the index shows a yearly price increase of 6.5 percent, first-year expenditures of $1 million must be increased by $65,000 in the second year to purchase the same goods and services.

What makes a price index so valuable is that by reporting *only* price increases, without quality or quantity changes, an index series documents the additional revenues required for continuation of business as usual. Few financial supporters can deny that funding should at least maintain the status quo if not improve upon it. Thus, price indexes reliably report increased funding requirements that can be defended as essential if services are to be maintained. If quality or quantity improvements are to be included, then the force of the argument would be lost since justification of the added costs to change operations is seldom obvious.

To achieve its intended purpose of reporting only price changes, a price index attempts to hold constant *all* other factors. A persistent and nearly irresolvable problem in this regard is eliminating the effect on prices of quality changes in the commodities and services purchased. When possible, a process of "linking" is used whereby the price of a new item is tied to the price of an old item by factoring out the price difference due to the change in quality involved. For personnel services, quality is fixed by specific job descriptions. Individual talents and training brought to professional positions are considered constant in the sense that new teachers and faculty consistently represent the current "state-of-the-art" in selection and preparation.

A price index must also hold constant the mix of inputs and, implicitly, the mix of programs. This is accomplished by establishing fixed budget weights corresponding to the various categories of inputs in the base periods. The price changes or price relatives are weighted according to this constant expenditure pattern. To the extent that faculty and researchers from year to year use *different* pedagogy, analyses, instruments, equipment, and materials or employ different mixes of personnel to accomplish objectives, use of a fixed-weight index fails to price current actual practice. Also, a price index does not account for changes

*The rather complicated theory of price index design and compilation is discussed in the next chapter. This brief explanation is provided here for those not interested in the details of chapter II.

in the mix of students; for example, an increase over time in the proportion of handicapped or graduate students and the associated higher overall per-student costs would not be reflected in a price index series.

Among other characteristics of a price index, it reflects a pattern of consumption for a group of consumers, not for the individual. Also, price indexes are slow to respond to changes in the consumers' pattern of consumption. These characteristics make price indexes least valuable to individual consumers whose buying patterns differ markedly from the norm and for those consumers who frequently alter what they purchase in response to changing needs and tastes.

To keep these limitations in mind, it is helpful to describe the index series as a "fixed input price index." Remembering this description further directs attention away from outputs and productivity changes, which are not considered unless reflected in production costs or transaction prices.

Price indexes have been developed for the general consumer (Consumer Price Index) and for a number of specific sectors of the economy. The most common misuse of price indexes is applying them to data or situations that they were not designed to cover. The need to convert actual or current-dollar figures to a constant-dollar basis, and the easy mathematical operation involved in doing this, tempt many persons to use any available price index for that purpose, rationalizing their choice in the mistaken belief that the prices of all goods and services move more or less uniformly in the economy. This is not the case, however. Thus, an index designed to measure the overall price change in a given grouping of items cannot be applied indiscriminately to other groupings.

As a case in point, the readily available Consumer Price Index (CPI) is often used in the field of education to convert per-student expenditures from an actual to a constant-dollar basis. However, the goods and services priced by the CPI are those purchased by families of city wage earners and salaried clerical workers, and they differ fundamentally from goods and services for education. The bulk of education purchases are for personnel services of faculty, whose price (salary) increases since 1974 have been less than those for classes of commodities represented heavily in the CPI. Thus, application of the CPI to educational institutions results in the erroneous and misleading adjustment of educational expenditures that does *not* reflect dollars of constant institutional purchasing power.

Price Index Data Summary

This study presents three price indexes specially prepared for the education community—the Higher Education Price Index, which prices the current operations of colleges and universities; the Research and

Development Price Index, which prices the direct expenditures of universities for sponsored research and development; and the School Price Index, which prices the current expenses of elementary-secondary schools. A historical summary of these indexes, college tuition, and, for com-

Table I-1

Price indexes for current operations in elementary-secondary schools and in higher education, for research and development, for building construction, for student tuition, for college and university faculty salaries, and for school classroom teacher salaries, and national indicators of inflation, fiscal years 1961-1982.

1967 = 100 **Annual percentage change in parentheses.**

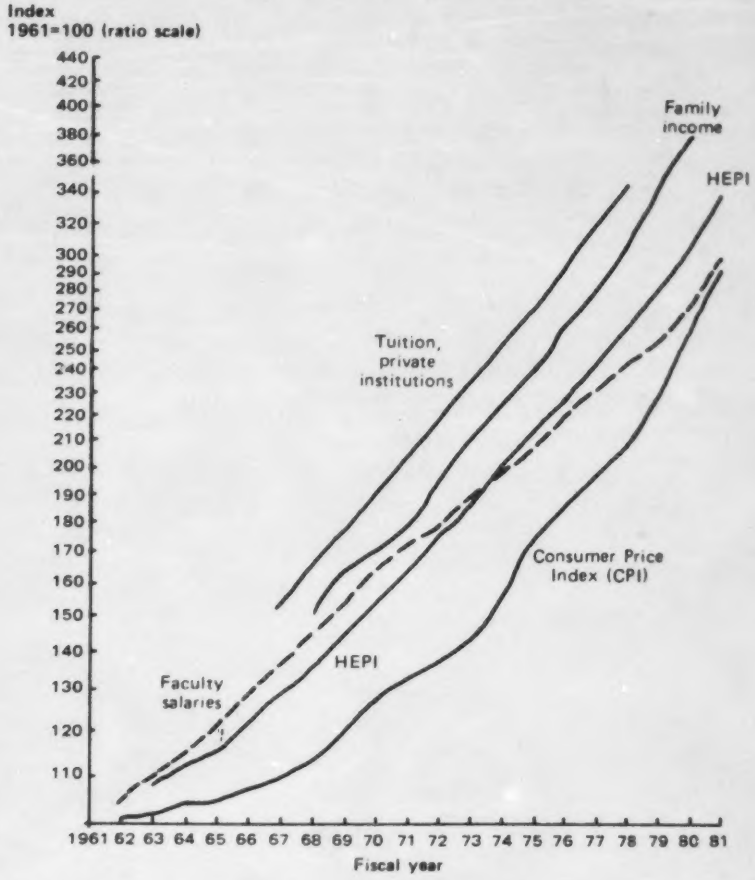
Fiscal year	Elementary-Secondary School Price Index (SPI)		Higher Education Price Index (HEPI)		Research & Development Price Index (R&DPI)	Building construction (Boeckh)	
	Index	Percent change	Index	Percent change	Index	Index	Percent change
1961 . . .			77.7	—	79.1	83.4	—
1962 . . .			80.5	(3.6)	81.4	85.2	(2.2)
1963 . . .			83.6	(3.9)	84.2	87.2	(2.3)
1964 . . .			86.8	(3.8)	87.3	89.4	(2.5)
1965 . . .			90.5	(4.3)	90.8	92.1	(3.0)
1966 . . .			95.0	(5.0)	94.7	95.5	(3.7)
1967 . . .			100.0	(5.3)	100.0	100.0	(4.7)
1968 . . .			106.0	(6.0)	105.5	107.3	(7.3)
1969 . . .			113.2	(6.8)	112.3	115.5	(7.2)
1970 . . .			120.8	(6.7)	119.3	124.0	(7.4)
1971 . . .			128.6	(6.4)	126.2	134.7	(8.6)
1972 . . .			135.8	(5.6)	133.0	145.7	(8.2)
1973 . . .			143.0	(5.3)	139.2	154.8	(6.2)
1974 . . .			153.1	(7.1)	148.2	165.3	(6.8)
1975 . . .	100.0	—	166.2	(8.6)	162.1	184.5	(11.6)
1976 . . .	108.6	(8.6)	177.2	(6.6)	173.6	198.7	(7.7)
1977 . . .	116.0	(6.8)	188.7	(6.5)	184.4	215.5	(8.5)
1978 . . .	123.9	(6.8)	201.3	(6.7)	196.3	231.0	(7.2)
1979 . . .	135.3	(9.2)	216.9	(7.7)	211.6	246.9	(6.9)
1980 . . .	147.5	(9.0)	238.3	(9.9)	230.7	267.3	(8.3)
1981 . . .	165.5	(12.2)	263.9	(10.7)	255.4	293.2	(9.7)
1982 . . .	181.7	(9.8)	290.1	(9.9)	278.1	322.4	(10.0)

parison, other national inflation indicators and family income data is presented in table I-1. The trend in values is shown graphically in figure I-1.

Student tuition		Consumer Price Index (CPI)		Family median income	College and university faculty salaries		School classroom teacher salaries		Fiscal year
Public institutions	Private institutions								
Index	Index	Index	Percent change	Index	Index	Percent change	Index	Percent change	
72.5	65.3	90.5	—	72.3	73.5	—			..1961
		91.4	(1.0)	75.1	76.8	(4.5)			..1962
		92.4	(1.1)	78.8	80.8	(5.2)			..1963
		93.7	(1.4)	82.8	84.5	(4.6)			..1964
		94.9	(1.3)	87.7	89.0	(5.3)			..1965
		97.1	(2.3)	94.9	94.1	(5.7)			..1966
100.0	100.0	100.0	(3.0)	100.0	100.0	(6.3)			..1967
		103.3	(3.3)	108.8	106.4	(6.4)			..1968
		108.3	(4.8)	118.9	113.3	(6.5)			..1969
		114.7	(5.9)	124.4	121.3	(7.1)			..1970
		120.7	(5.2)	129.6	127.2	(4.9)			..1971
		125.1	(3.6)	140.1	131.7	(3.5)			..1972
		130.0	(3.9)	151.9	137.4	(4.3)			..1973
158.3	165.6	141.6	(8.9)	162.6	144.4	(5.1)			..1974
168.6	176.3	157.4	(11.2)	172.9	152.3	(5.5)	100.0	—	..1975
180.4	192.0	168.5	(7.1)	188.6	161.1	(5.8)	108.1	8.1	..1976
188.3	208.9	178.3	(5.8)	201.8	168.7	(4.7)	114.0	5.5	..1977
205.2	226.2	190.3	(6.8)	222.4	177.6	(5.3)	121.1	6.3	..1978
219.4	245.1	208.1	(9.3)	247.8	187.9	(5.8)	129.5	6.9	..1979
233.6	267.6	235.9	(13.3)	265.0	201.3	(7.1)	138.3	6.8	..1980
250.6	302.3	263.1	(11.6)	282.2	218.6	(8.6)	153.6	11.1	..1981
268.0	349.8	285.9	(8.7)		236.9	(8.4)	167.5	9.0	..1982

Figure I-1

Comparison of trends in cumulative price change in higher education current operations (HEPI), faculty salaries, tuition at private institutions, family income, and the consumer price index, fiscal years 1961-1981.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

II. PRICE INDEX THEORY AND COMPUTATION

Prices can be measured either in units fixed at the point at which transactions take place or in terms of the utility or satisfaction that consumers expect to derive from their purchases.

The first approach reports the prices of goods and services as per contract between the buyer and seller, since this is the only point at which the value of purchases is settled and measurable. A pure *price* index follows this technique in reporting the changes in prices of a *fixed* group of goods and services of *constant quality*.

The second approach attempts to report, as a lower price, any increase in consumer *satisfaction* brought about by improvements in product quality. The idea is to substitute a measure of benefit for the item unit in which the transaction was made. Tires, for example, could be priced on a cost-per-mile basis rather than the price per tire. A *cost* index used this approach in reporting the change in total money expenditure a consumer must make to maintain a *constant level* of utility from the purchase of a variable group of products. Shifts are made in the quantities purchased so as to maintain the constant utility level most economically in each time period.

While these abbreviated descriptions of price versus cost indexes appear simple, the concepts involved require explanation. Further, if the indexes are to be used properly, the distinctions between them must be understood. The distinction requiring greatest clarification is that of quality changes—a pervasive problem in measuring economic phenomena.

General Concepts

An *index* number measures changes in prices, wages, employment, and the like by showing the percentage variation from an arbitrary standard, usually 100, representing the status at some earlier time. A price index measures the average change in the price of goods and services purchased by a particular group of consumers. The *amount* and *quality* of the selected commodities that comprise the market basket being indexed must remain *constant* so that only the effects of price changes are reflected. Under these restrictive conditions, the price index (in actuality its reciprocal) is a measure of the purchasing value of money.

For consumers, both the quantity and the quality of items purchased, as well as the amount spent on each, tend to change. Goods once included in the budget may no longer be needed. Items previously not in existence may have been added. Some items may be substituted for others. Changes of this kind must have no effect on price index values. When new products are introduced and old ones dropped, the discontinuity is overcome, within limits, by factoring out the price differences due to the substitution. This procedure, called "linking," is explained in this chapter under the heading "Adjustments for Quality Changes." Products are also continually redesigned to modify or improve their quality. A price index reports such changes only if higher producer costs or product prices are involved; improvements that cannot be measured in dollars and cents are ignored. The price differential of a quality improvement is determined by comparing, at a common moment in time, the relative market prices between the old and the new product versions.

It is sometimes difficult to accept the fact that a price index does not account for changes in product quality and in consumer satisfaction other than those measured as a directly related increase in market price or production cost. But there is currently no statistically reliable way to measure a person's needs or the degree to which these needs are satisfied by particular goods or services. Economic welfare, and in our case educational welfare, as a measurable idea is currently restricted to reporting the amount of goods and services purchased per capita, with the implication that the more purchased the better off the individual. Without a means of measuring the value or return on educational purchases, it is impossible to estimate, as is required for pricing, what constitutes equivalent educational returns or outputs over time. Consequently, if intangible utility considerations were introduced, it would inject an element of subjective judgment that would destroy the useful economic analysis the price index now provides.

There are, of course, certain instances where product value or utility can be measured and reported for use by the benefit-conscious consumer. Such a measurement, generally called a cost index, usually involves only a single product or narrow group of products.[1] A cost index for computers, for example, would report the decrease in unit data processing costs for a series of improved models, whereas a price index would report only changes in price for a given computer. If new, insulated jackets are warmer, a cost index measures changes in price for a fixed number of warmth units, while a price index reports the change in price

[1]An example of a subjectively estimated "cost" type index is the poverty index prepared by the Bureau of the Census. This index, which focuses on the U.S. Department of Agriculture's Economy Food Plan, reflects the different consumption requirements of families based on their size and composition, sex and age of the family head, and farm or nonfarm residency. See U.S. Department of Commerce, Bureau of the Census, *Revision in Poverty Statistics, 1959 to 1968*, Current Population Reports, Special Studies, Series T-23, No. 28, Washington, D.C., Aug. 12, 1969.

for a specific jacket. While these cost/fixed-benefit ratios are of great value to the consumer, they report only one of many values the consumer seeks and pays for, and for most goods and services even such limited benefit measurements are not possible.

A special circumstance is the pricing of new building construction. The intention is to establish the cost of a *completed* hypothetical structure by pricing a fixed list of labor and material *inputs*. However, new materials and assembly techniques have improved construction efficiency over the years—a type of input quality change. These improvements in productivity are taken into account by pricing inputs per unit of completed or in-place construction. This topic is discussed in some detail in chapter V.

More extended treatment of index theory is provided by the bibliographical references provided in appendix B. In particular, the Bureau of Labor Statistics' *Handbook of Methods*, Wasserman's *Education Price and Quantity Indexes*, and Jack Triplett's paper "The Measurement of Inflation: A Survey of Research on the Accuracy of Price Indexes" in *Analysis of Inflation* (Paul H. Earl, ed.) are recommended for initial reading.

The Problem of Quality Changes

In the simplest sense, it is possible to obtain an unambiguous measure of true price change only by comparing prices for the *same* goods available in the current year as they existed in the base year. However, any group of goods and services cannot long be kept constant, for the quality and design of the products are changed from time to time. Thus, computing a pure (fixed-input) price index presents the problem of properly accounting for the changing characteristics of the inputs being priced.

In practice, this accounting is accomplished by application of three rules. The first rule is: *Changes in quality can be measured by the difference in prices of the product varieties as of a common moment in time.* This assumes that differences in price are a measure of relative value. If perfect competition is assumed, the relative prices are a measure of both relative costs and relative utilities. The difference in prices is considered an output increase and is *excluded* by linking the prices of the product varieties involved.

Customers, however, are sometimes ignorant of changes in product quality and are inconsistent in their evaluation of worth. The price differential between two similar products may, or may not, accurately reflect their difference in quality.

When price data are suspect or both varieties of a product are not produced simultaneously, a second rule applies: *Changes in quality can be*

measured by the differences in research and production costs (including profit) associated with the improvement.

As an example, suppose the single new feature of a given computer model is an expanded memory capacity. This quality improvement must be assessed by the additional research and production costs involved, independent of any change in the posted price of the computer. The additional cost is counted as a change in output. If the price in the year in question has changed by an amount different from the cost of the improvement, the difference constitutes a true price change. The price may be lower if computer manufacturers are taking the occasion to pass on to the consumer the savings in costs achieved through productivity increases. It may be higher if prices are being affected by inflationary forces.

Where changes in quality cannot be measured or estimated by either of the above means, a third rule applies: *Quality changes which lie outside the realm of economic measurement must be disregarded, like changes in style or taste.* Judging the value of quality change either objectively or by the subjective value to the consumer must be rejected because of inconsistencies and therefore lack of economic meaning.

In practice this rule takes two counterbalancing forms:

a) Where the quality change is deemed "small," all of the observed price change is recorded as pure price change. Making no allowance for actual quality improvements results in an upward bias in the index.

b) Where the quality change is recognized as too large to ignore, all of the observed price differential is counted as quality change. Making no allowance for any actual price increases involved results in a downward bias of the index.

It would be extremely difficult to arrive at any consensus among experts on the criteria for evaluating product quality. Any improvement would likely involve a number of factors, all of which would have to be weighted according to common agreement on their importance. There is no practical way that conflicts regarding objective standards could be resolved to explain price determination.

It is also suggested that the difference in quality between two varieties of a product, or two different products, can be judged by comparing their relative utilities (consumer satisfaction) at a given time. Although plausible in a few cases, e.g., the greater utility of a lower price per mile improved tire, this measure of utility cannot be made through the whole range of goods and services, and if done in only a few isolated cases, it would result in an arbitrary and meaningless index. Equally detrimental is the injection of a wide element of subjective judgment regarding what constitutes consumer satisfaction, which would destroy the present usefulness of index numbers constructed solely on measurable phenomena.

To illustrate how intangible improvements occurring in education are treated in index compilation, consider teachers and faculty services. It is evident that, over the years, the acquisition of more knowledge has increased the level and scope of instructed content. Schools and colleges may well pay faculty more for this improvement in their services, or because more of them hold Ph.D.'s or are, on the average, older and more experienced, or they are working longer hours. If improvements of this type are recognized in contracts for faculty services with added compensation, such differences in salary represent an additional cost for expected better quality or extended faculty service and must *not* be considered a price increase.

Changes in price paid for improved faculty quality also cannot be measured by associated increases in production (teacher-education) costs. Tuition and fees charged prospective faculty graduate students are not raised progressively each year to cover the added expenses of improvements in education provided. New faculty are more costly to educate because of rising costs of the education process, not because of greater effort to produce better teachers. Colleges and universities consistently attempt to provide all students the best education possible within the limits of institutional resources.

We cannot directly measure the satisfaction an institutional consumer gains from the purchase of faculty services. Without such a measure, and in the absence of detailed contractual provisions stipulating faculty expectations, it is impossible to determine what component of salary increases is being paid for expected services. Colleges have no opportunity to buy "last year's" faculty and compare them side-by-side with current "models" for pricing purposes. Each year's new faculty enters the labor market qualified by current educational practice and representing the best (and only) available teaching and research service for hire. They are paid according to supply and demand—not improved quality.

In dealing with faculty services, the nonquantitative aspects of quality change, consumer satisfaction, and production costs prevent any measurement of prices for index purposes other than in the unadjusted units in which the transaction takes place, i.e., salary paid for a contracted period of service. While there is no standardized basket of faculty services that is determined solely on educational grounds, faculty services are consistently the best and only quality available for hire at any given time and, from this standpoint, represent a relatively constant state-of-the-art from year to year.

Formulas and Computation

The fixed-input index numbers compiled in this study are calculated by a Laspeyres-type formula, generally referred to as a weighted average of

price relatives. The formula and its application are illustrated by the following example.

Assume that a price (sub)index is to be constructed for three items—writing paper, pencils, and envelopes. (A price subindex for office supplies could be based on price changes in a sample of three such items or on inputs selected to represent all office supplies.) These items and their prices in periods 0, 1, and 2 are as follows:

Item	Unit	Unit price in period		
		0 (base)	1	2
Writing paper	Ream	$2.00	$2.50	$2.80
Pencils	Dozen	.22	.29	.33
Envelopes	100	.70	.77	.84

The price relative of an item is its price during a current or given period expressed as a percent of its price during the base period. If period 0 is taken as the base, the price relatives for writing paper would be 100 for period 0 and 125 for period 1, since $2.50 is 125 percent of $2. The price relatives for all three items would be:

Item	Price relatives percent in period		
	0	1	2
Writing	100	125	140
Pencils	100	130	150
Envelopes	100	110	120

A price index measures the average price change in a group of items. Since these three items are probably not of equal importance in the expenditure patterns of the buyer, a weighted average must be used. The weights should reflect the relative importance of each item affecting the overall price change for all items. The importance of an item for price index purposes is indicated by the dollar expenditure for the item during the base period expressed as a percent of total budget expenditures for all items being priced.[2] In a fixed-weight price index, these relative weights are held constant.

[2]This relative method of weighting is employed in this study, rather than weighting by actual quantities, because it is more feasible to determine spending patterns reported by institutions than to collect purchase-quantity data. The index weights are derived by determining stable relationships for selected goods and service items among average institutional expenditures. The assignment of weights in this manner makes it impossible to identify the physical quantities attached to each index item; quantity weights therefore are only implicit in the index structure.

As an example, say that the relevant dollar expenditures during a typical period serving as the base are as follows:

Items	Dollar expenditures	Relative weights (percent distribution)
Writing paper	$3,000	0.75
Pencils	400	.10
Envelopes	600	.15
Total	$4,000	1.00

In combining the price relatives of the three items in a particular year to obtain the subindex value for that year, the first item is given a weight of 0.75, the second item 0.10, and the third item 0.15.

The price subindex for office supplies is calculated in the following table. First, the price relatives are multiplied by their respective weights, and the arithmetic products of all items are added within each period. Then, the index value is obtained for any period by the sum of the weights. When relative weights are used, this final step is not necessary as these weights sum to 1.0.

(Period 0 = 100)

Items	Price relatives in period		Relative expenditure weights	Price relatives × weight	
	1	2		1	2
	$\frac{P_{1i}}{P_{0i}} \times 100$	$\frac{P_{2i}}{P_{0i}} \times 100$	W_i		
Paper	125	140	0.75	93.75	105
Pencils	130	150	.10	13.00	15
Envelopes	110	120	.15	16.50	18
			$\Sigma_i W_i = 1.00$	123.25	138

Index values: For base period 100
For period 1 123.25
For period 2 138

In addition, it is obviously neither feasible nor necessary to include in an index computation *all* items purchased by colleges and universities. As with the Consumer Price Index, judgment and common sense are used to select a *stratified* sample that gives proportional representation to each *class* of items, e.g., supplies and materials, and *random* sampling of "priceable" items *within* each class, e.g., soaps, paints, writing paper, to be representative of all items in the class.

The formula for a price index calculated by this method of a relative weighted average for price relatives is $\Sigma_i \frac{P_{ni}}{P_{0i}} \times 100 \times W_i$. In this formula, for an item in general—i.e., item i—the average price in the base period (period 0) is designated at P_{0i}, in period 1 as P_{1i}, and so on. The price relative for period 1 is designated $\frac{P_{1i}}{P_{0i}} \times 100$. The subscripts 0 and n in the formula are used to designate the base period and any given period, respectively. Thus, a given period price relative for item i would be $\frac{P_{ni}}{P_{0i}} \times 100$.

Adjustments for Quality Changes

Although generally the same goods and services are priced year after year, it is necessary to provide a means for bridging over changes in product specifications that may occur. When the specifications change for an existing commodity, the new price series resulting from the change is substituted for the earlier series by direct comparison or by linking. If the specification change is minor and does not involve price setting factors, the substitution is made by direct comparison and any reported price change between the old and the new specification is reflected in the index. If the change in specification is major, and neither a price change occurred nor information can be obtained concerning the value of the difference in specification, the substitution is made by linking and no change is reflected in the index. If the change is major and the value of the additional feature is known, the linking process is used to continue the price series, excluding the difference in price known to be a result of the specification change.

These three types of adjustments are explained by the following tabulations.[3]

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[3]Adapted from: Ethel D. Hoover, "The CPI and Problems of Quality Change," *Monthly Labor Review*, Vol. 84, No. 11, November 1961, p. 1178.

1. Direct comparison

	Base period	Period of substitution	Later period
Reported price	$1.63	$1.94	$1.70
Price relative	...	$\frac{\$1.94}{\$1.63} \times 100 = 119.0$	$\frac{\$1.70}{\$1.94} \times 100 = 87.6$
Price index	100.0	119.0	$\frac{119.0 \times 87.6}{100} = 104.2$

2. Linking (difference in price between new item substituted for old item due exclusively to quality change)

Reported price:			
Old item	$5.00	$5.50	...
New item	...	$6.00	$6.25
Price relative	...	$\frac{\$5.50}{\$5.00} \times 100 = 110.0$	$\frac{\$6.25}{\$6.00} \times 100 = 104.2$
Price index	100.0	110.0	$\frac{110.0 \times 104.2}{100} = 114.6$

3. Linking (difference in price between new item substituted for old item due to changes in both quality and price)

Reported price:			
Old item	$3.00	...	...
New item	...	$4.00	$4.50
Value of quality difference between old and new items	...	+$0.35	...
Price relative	...	$\frac{(\$4.00-\$0.35)}{\$3.00} \times 100 = 121.7$	$\frac{\$4.50}{\$4.00} \times 100 = 112.5$
Price index	100.0	121.7	$\frac{121.7 \times 112.5}{100} = 136.9$

When the quality of an item remains relatively constant over time, price changes from one period to the next may be calculated by direct comparison (example 1): dividing the price for an item in the current period by the price in the preceding period. A simple procedure, it has been used as required for all subindexes in this report.

The linking process ties the price of a new item to the price of an old item by factoring out the price difference due to a change in quality. The difference (example 2) in price between the two items purchased during the period of substitution is assumed to be due exclusively to a quality change. By linking, this price change is not reported as an increase in index value. The price of the new item during a later period divided by its price during the period of substitution is called a link relative. The price index for the later period is calculated by multiplying the price index for the period of substitution by the link relative.

When the price difference between the two items is due to changes in both quality and price, the procedure in example 3 applies. This involves reducing the price of the new item during the period of substitution by the estimated price value of the quality difference involved (as determined, for example, by the added cost of producing the new item), then comparing the adjusted price of the new item with the price of the old item during the previous period.

Estimating the price value of quality changes requires considerable information about both quantities purchased and product specifications. The amount of effort required to secure these data and the amount of improvement that will accrue to index validity are primary factors to consider in determining the extent to which the linking methodology should be employed.

Adjustments for Quantity Changes

As the buying habits of consumers change, they may purchase more of certain goods and services and less of others. A price index attempts to hold the quantity of all items under consideration fixed so that index values reflect only price changes. However, over an extended period of time, certain adjustments in item weights may be necessary if the index is to reflect the current consumption pattern.[4] When significant changes do occur in the composition of the market basket being priced, linking may be used to avoid disrupting the continuity of the index series. However,

[4]It should be noted, however, that in many instances carefully established weights for official indexes may not be varied for many years. For example, the weights adopted in the 1952 and the 1967 revisions of the Consumer Price Index were held essentially constant for more than a decade. The Bureau of Labor Statistics reweights the 52 major item classifications of the CPI every 10 to 15 years; minor item components are changed frequently to include new and modified products and services. As a practical matter, reweighting of the CPI has almost no appreciable effect on index values. Error is caused primarily by inaccuracies in collecting price information, not in index weight.

revisions should be held to an absolute minimum since they result in an inconsistency in the index series; namely, two different item mixes are presented, which prevents their exclusive true price comparison over time.

The most direct method of weighting the different items to be priced for index purposes is by actual physical count. Only by weighting each item by the amount or quantity purchased can the relationship between the total cost of buying a given set of goods and services be compared over time. Any other weighting system, such as the use of relative weights based on the proportion of budget expended for each item, serves as a proxy for physical counts. Use of the *initial* budget proportions for relative weighting in subsequent years results in an index number series exactly equivalent to using fixed quantity weights. Later period budget proportions must not be substituted for the initial relative weights since they reflect changes in *price* as well as in quantity. In effect, this results in a double counting type of error.

In the tabulation below, the index of price change from period 1 to period 2 based on total budget comparisons and fixed physical quantity count is 1.4375. This accurate relative price change is also obtained by using fixed budget proportions (period 1) of 0.25 and 0.75. However, when period 2 budget proportions are substituted, the derived index of 1.4457 is in error. During the periods of rising prices, use of variable budget proportions in weighting results in an upward bias of index values.

Price change only

Weighting based on fixed physical quantity count

	Period 1		Period 2	
	Price	Quantity	Price	Quantity
Item A	$1.00	1	$1.25	1
Item B	$1.00	3	$1.50	3

Total budget
$1.00 × 1 + $1.00 × 3 = $4.00

Total budget
$1.25 × 1 + $1.50 × 3 = $5.75

$$\text{Total budget ratio period 2/period 1} = \frac{\$5.75}{\$4.00} = 1.4375$$

Price change only

Weighting based on budget proportions

	Period 1				Period 2			
	Price relative	Quantity	Total expenditure	Budget proportion	Price relative	Quantity	Total expenditure	Budget proportion
Item A	$1.00	1	$1.00	0.25	$1.25	1	$1.25	0.2174
Item B	$1.00	3	$3.00	.75	$1.50	3	$4.50	.7826
			$4.00	1.00			$5.75	1.0000

Index value (price relative × budget proportion)

$1.00 \times 0.25 + 1.00 \times 0.75 = 1.000$

Index value based on **fixed** (period 1) budget proportions

$1.25 \times 0.25 + 1.50 \times 0.75 = 1.4375$

Index value based on **variable** (period 2) budget proportions

$1.25 \times 0.2174 + 1.50 \times 0.7826 =$ 1.4457 (overstated)

Price and quantity change

	Period 2			
	Price relative	Quantity	Total expenditure	Budget proportion
Item A	$1.25	1	$1.25	0.1724
Item B	$1.50	4	$6.00	.8276
			$7.25	1.0000

	Budget proportion	=	Price relative	×	Unknown quantity	Relative quantity
Item A	0.1724	=	1.25	×	0.13792	0.20
Item B	.8276	=	1.50	×	.55193	.80
					.68985	1.00

Index value based on **fixed** (period 1) budget proportions

$1.25 \times 0.25 + 1.50 \times 0.75 = 1.4375$ (understated)

Index value based on **variable** (period 2) budget proportions

$1.25 \times 0.1724 + 1.50 \times 0.8276 = 1.4569$ (overstated)

Index value based on relative quantity (period 2)

$1.25 \times 0.20 + 1.50 \times 0.80 = 1.4500$

The use of initial budget proportions for relative weighting is accurate so long as the physical quantity proportions among items remain relatively constant. When there is a significant change in the buyer's consumption pattern, an adjustment in weighting must be made. If proportionately smaller quantities of items with large price increases are being purchased, for example, continued use of initial budget proportions will result in overstated index values.[5] This is because index values based on fixed weights do not reflect the reduced importance that should be given to price changes of items being bought in smaller quantities. In the same circumstances, if new budget proportions are substituted, index values will be overstated because the price change of high inflation items will increase their budget proportions more than the actual change in relative physical count.

To avoid such errors, reweighting should be based only on recognized changes in the buyer's consumption pattern, i.e., buying proportionately greater or smaller quantities of different items. Under this approach, weights are equal to the new quantity mix. If these quantities are not known, they can be calculated by dividing the known new budget proportion by the known price relative for each item. The lower calculations on this page illustrate the procedure. Dividing the known budget proportions, 0.1724 for item A and 0.8276 for item B, by the known price relative for each item, $1.25 and $1.50, establishes the unknown quantities as 0.13792 and 0.55193, respectively. Use of the relative quantity percentages of 0.20 and 0.80 (corresponding to the purchase of one unit of item A and four units of item B) results in an index value of 1.4500, which is between the understated 1.4375 index value based on fixed initial budget proportions and the overstated 1.4569 index value based on variable budget proportions.

How has the above theory been applied in weighting the indexes in this study? In the case of the Higher Education Price Index, the proportion of the educational and general budget expended by institutions for personnel compensation has gradually increased, suggesting the need for weight revisions. In 1964-65, the proportion of the total educational and general budget (less sponsored research) spent for personnel compensation was 74 percent, with 26 percent expended for contracted services,

[5]This example is selected because colleges and universities are likely to be purchasing proportionately less supplies and materials, books and periodicals, and especially utilities, all with highly inflationary price increase rates. Thus, institutions probably purchase fewer gallons of fuel oil relative to the number of faculty than previously purchased. Contrary to what most people believe, the HEPI is probably overstating the inflation affecting colleges and universities because the weighting for utilities has not been reduced. (This is true despite the fact that the proportion of the budget for utilities is substantially greater.)

supplies, and equipment. In 1971-72, the percentages were 82 and 18, respectively. It would be a simple matter to reweight the index based on the new budget proportions, but, as explained, reweighting should be performed only when the buyer's consumption pattern changes. To determine to what extent the changing budget proportions represent the purchase of additional quantities of personnel services and proportionately smaller quantities of contracted services, supplies, and equipment, it is necessary to calculate the new relative physical quantities.

For the 1965-72 period, the relative price increase in personnel compensation was 56.1 percent (from an index value of 88.7 to 138.4, as shown in table III-1, page 38). The price of services, supplies, and equipment increased 31.5 percent (from an index value of 95.5 to 125.6). Since the budget proportions for 1965 and 1972 are known, it is a simple matter to calculate the unknown quantity changes as follows:

	Known 1964-65 budget	=	Known price relative	×	Known quantity*	Relative quantity* (percent)
Personnel compensation	$0.74	=	100.0	×	.7400	74
Services, supplies, and equipment..	.26	=	100.0	×	.2600	26
	$1.00				1.0000	100
	1971-72 budget				Unknown quantity*	
Personnel compensation	$0.82	=	156.0	×	.5256	79.3
Services, supplies, and equipment..	.18	=	131.5	×	.1369	20.7
	$1.00				.6625	100.0

*The term "quantity" is used here to report change in the physical consumption pattern relative to 1964-65 quantities implied by the 1964-65 expenditure budget.

These calculations show that colleges and universities have been employing relatively more faculty and staff each year and buying proportionately smaller amounts of services, supplies, and equipment.[6] If the relative implied quantities in 1964-65 were 74 percent for personnel compensation and 26 percent for services, supplies, and equipment, then the above computations suggest that these percentages have changed to 79.3 percent and 20.7 percent, respectively, in 1971-72.

[6]This change undoubtedly reflects the efforts of colleges and universities to economize by reducing support services, supplies, travel, and other administrative and overhead expenses.

For purposes of index computation, the 1964-65 weights have been used for the 1961-72 period[7] and the 1971-72 weights have been used from 1972 to the present. The two series have been linked in 1972 to establish the same HEPI value computed using either set of weights. Although "linked" to establish equivalency, the two series measure price change for two different item mixes. As a result, certain discontinuity occurs that prevents the comparison of prior- to post-1972 index values from exclusively representing price changes.

The weights have not been revised since 1972 because, until recently, only a few institutions reported expenditures by object classification. However, greater demand for accountability has prompted an increasing number of colleges and universities to adopt the object classification system, which makes a reweighting investigation more feasible. Also, there is a strong likelihood that new technology and the pressures of inflation have encouraged colleges and universities to alter their buying patterns in recent years. Another argument for a weighting review is interest in specialized indexes for the various types of institutions. However, a substantial variation in buying patterns would be required to justify the high cost of differential computations.

Assumptions in Developing Education Price Indexes

Price index design and computation requires a number of assumptions to derive practical measures. The initial assumptions are made in choosing the form of the index. Others are necessary to accommodate real world conditions and measurements that do not always meet theoretical requirements. However, price index theory exhibits certain accommodating characteristics or flexibility that provides strong rationale for the assumptions made.

The assumptions have been organized in three categories dealing with index theory, market basket construction and weighting, and price series. Each assumption statement is followed by explanatory commentary including justifying circumstances.

Price Index Theory

1. *As a measure of inflation, a pure price index is superior to a cost index.* A pure price index reports changes in price of a fixed group of goods

[7]Technically, it is incorrect to apply budget weights backwards in time, i.e., using 1964-65 weights to calculate HEPI values for the four previous fiscal years. To avoid any form of double counting in the event the mix of purchases has changed, weighting should only apply forward to succeeding periods. However, in the absence of any weighting data for 1961, an exception has been made to allow the HEPI to be calculated back to 1961, when the first reliable price data for faculty became available.

and services of constant quality. The effects of inflation are thus measured in terms of the changing value or purchasing power of dollars spent.

A cost index reports, as a lower price, any increase in satisfaction brought about by improvements in product quality. The idea is to substitute a measure of benefit for the item unit. While this may be feasible for certain mechanical goods, many values of education cannot be measured and, therefore, the "productivity" of education for corresponding dollar inputs cannot be reported.

2. ***The Laspeyres-type, or fixed weight, formula is superior to the Paasche, or variable-weight, approach for measurement of inflation.*** In a fixed-weight price index, the relative weights of goods and services being priced are held constant. The index reports only price changes and may be interpreted as the change in resources required to offset the effects of inflation in buying the same kinds and amounts of goods and services previously purchased. When significant changes occur in the composition of the market basket being priced, weights are revised, but such revisions are held to an absolute minimum. The labor-intensive education process involves fairly stable inputs that lend themselves to such fixed-weight assignments.

The Paasche-constructed index varies the weights of items being priced according to the changing preferences of the consumer. When preference changes occur frequently, the index measures both the effects of inflation and the changing costs of different modes of operation. The index is therefore unsuitable for the exclusive measure of inflation.

3. ***Expenditures in higher education should be grouped into distinct functional categories for pricing purposes (e.g., education and general, sponsored research, overhead, auxiliary enterprises) to facilitate proper index application.*** The varied nature of college and university activities and the need for distinctive price information in selected areas suggest the need for separate pricing of education and general current operations, sponsored research, plant funds, overhead, and auxiliary enterprises. Each activity requires a separate index. And since their relative importance varies greatly among institutions, a composite measure based on national averages would have little relevance to any given institution.

4. The HEPI, R&DPI, and SPI provide valuable data to the education community and warrant publication, despite certain limitations. Establishment of education price indexes on a par with the Consumer Price Index would require a massive data collection involving not only detailed identification of goods and services purchased, but also independent price collection and appraisal of product quality and associate price differentials. Such a collection effort is beyond the scope of most Federal

agencies not specifically tasked with this mission or staffed accordingly.

The HEPI, R&DPI, and SPI achieve an acceptable level of validity with minimal investment. The benefit-cost ratio is exceptionally high. Additional large investments in price index development are likely to result in only modest improvements, with consequent low benefit-cost ratios.

Market Basket Construction and Weighting

1. ***Market basket items may be weighted according to budget proportions as a perfect substitute for actual physical count.*** Rather than conduct a difficult physical count of the set of goods and services being priced, budget proportions expended for each item may be substituted without error. Use of the initial budget proportions for relative weightings in subsequent years results in an index number series exactly equivalent to using fixed-quantity weights. However, later budget proportions must not be substituted for the initial relative weights since they reflect changes in price as well as quantity changes.

2. ***Slight errors in weighting result in minimal and acceptable errors in the overall index series.*** Index validity depends primarily on selecting suitable price series and holding budget weights constant. Modest errors in weights attached to expenditure categories have little effect on the overall index values. This is because the HEPI and SPI are dominated by the trend in faculty and teacher salaries and because of similarity in the salary trends for other personnel hired by colleges and schools. Even a substantial difference in weighting does not have too great an effect on index values. For example, if in 1967 the 1.7 percent budget weight attached to books and periodicals of the HEPI (where price inflation was 7 percent annually) were transferred to equipment (where prices increased only 3.75 percent annually), the 1974 HEPI value of 152.8 would be reduced only 0.6, to 152.2.

3. ***Individual institutions and schools may use published price series to tailor and construct price indexes to their own budget mix. Nationally published indexes should be limited (like the CPI) to national average data for the major organizational components of education.*** Commitment of additional resources to index compilation and data collection may permit publication of price indexes for the various types of public and private institutions of higher education and separately for elementary and for secondary schools. However, this would involve substantial collection of additional information.

The similar price series faced by the various sectors of education suggest that, in the long run, specialized indexes would have price trends highly similar to the HEPI or SPI.

4. *Because there is little change over time in the composition of the market basket of goods and services purchased by colleges and universities and schools, only periodic weight adjustments are necessary.* Education is a labor-intensive industry. The mix of personnel has been developed by trial-and-error, governed by the need for economy, and the current personnel organization is highly effective. Further, the supporting goods and services purchased are for essential fundamental operations such as communications, transportation, printing, supplies and materials, books and periodicals, and utilities. Requirements for these basic supporting items change very little over time.

Conditions most likely to cause a change in the market basket are advances in technology leading to the purchase of new goods and services, and rapid price increases in certain items, such as utilities, leading to a reduction in purchased quantities to save money.

Price Series

1. *In dealing with faculty and teacher services, the nonquantitative aspects of quality change prevent measurement so that faculty "quality" is assumed to be a constant state-of-the-art.* Changes in the price paid for improved faculty and teacher quality cannot be measured by associated increases in production (teacher-education) costs. Tuition and fees charged prospective faculty graduate students are not progressively raised each year to cover the added expenses of improvements in education provided. Also, the satisfaction and institutional consumer gains from the purchase of faculty services cannot be directly measured. Without such a measure, and in the absence of detailed contractual provisions stipulating faculty service expectations, it is impossible to determine what component of salary increases is being paid for expected better service. Colleges have no opportunity to buy "last year's" faculty and compare them side-by-side with current "models" for pricing purposes. Each year's new faculty enters the labor market qualified by current educational practice and representing the best (and only) available teaching and research service for hire.

2. *Fringe benefits may be regarded as a package preinvestment of earnings that, together with salary, constitutes the total across-the-board compensation institutions must pay to attract and hold competent staff.* The price series for fringe benefits does not price a fixed package of benefits that has a constant form and quality. A fixed package of fringe benefits may, in fact, be impossible to define, necessitating the interpretation adopted. The principal difficulty is in defining a future fixed standard of living and estimating its future cost to be partially met by retirement income established through a uniform series of yearly contributions. Any change in the estimated future retirement income re-

quired would result in higher or lower yearly contributions—a price change.

However, retirement contributions by institutions are not set to provide a future fixed standard of living. Rather, they are set so that, in combination with salary, total compensation is competitive in the labor market.

3. ***Because of the lack of detailed data on the supplies, materials, and equipment used by colleges and universities and schools, it is acceptable to use simplified item categories for which price series are available.*** Institutions of higher education and elementary-secondary schools purchase a variety of supplies, materials, and equipment, of which only certain items are priced by the Department of Commerce Producer Price Index (PPI) with attention to holding quality constant. Many specialized items purchased by colleges and schools are not priced by the PPI, and surrogate measures must be used.

III. COLLEGE AND UNIVERSITY CURRENT OPERATIONS PRICES AND INDEXES

Colleges and universities, along with other agencies and businesses in the economy, have had to contend with rising prices for many years. The gradual loss of buying power was not a real concern of educators as long as their institutions remained financially healthy. Now, however, declining enrollments and financial difficulties are forcing officials to take a hard look at spiraling costs and at what can be done to hold the line. And with some urgency, institutions are seeking measures of the impact of inflation on education budgets as a starting point for seeking additional income to meet expected higher unit costs.

There is need for distinctive price information in four areas of college and university activities—current operations, sponsored research, building construction and equipment, and student tuition. These topics are covered in chapters III through VI, respectively.

This chapter presents a suitable indicator for measuring the effects of inflation on the current operations of colleges and universities—the Higher Education Price Index (HEPI). The HEPI reports the change in prices paid by institutions for a fixed group of inputs purchased for educational and general operations, less sponsored research. The index and its components are presented in table III-1, page 38, and are described in detail beginning on page 50. The sections immediately below illustrate how the index can be used in the economic analysis of higher education financing trends.

The Effects of Inflation on Current Operations

Price Trends

In the 20-year period 1961 through 1981, the prices paid by colleges and universities for their educational and general operations (less sponsored research) more than tripled. The HEPI for 1961 was 77.7; for 1981, 263.9. Thus, for every $100 spent in 1961 for instruction, administration, libraries, plant operation and maintenance, and similar goods and services, $340 is needed today to buy the same goods and services.

Table III-1

Higher Education Price Index and major component subindexes, fiscal years 1961-1982.

1967 = 100 (Number code in parentheses identifies category as outlined in table III-4.)

Fiscal year	Personnel compensation			
	Professional salaries (1.0)	Non-professional wages and salaries (2.0)	Fringe benefits[1] (3.0)	Total[2]
1961	73.2	85.2	54.9	73.4
1962	76.7	87.5	59.6	76.8
1963	80.7	89.7	64.9	80.6
1964	84.4	91.9	70.8	84.3
1965	89.0	94.0	78.1	88.7
1966	94.1	96.5	90.2	94.1
1967	100.0	100.0	100.0	100.0
1968	106.5	105.2	111.1	106.8
1969	113.5	110.9	131.7	115.0
1970	121.4	117.7	146.2	123.5
1971	127.5	126.9	162.0	131.2
1972	132.5	136.1	180.2	138.4
1973	138.4	144.3	197.7	146.0
1974	145.4	153.4	222.0	155.3
1975	153.6	165.7	241.0	165.5
1976	161.6	179.1	266.7	176.4
1977	169.2	191.5	295.0	187.1
1978	177.9	206.5	324.3	199.2
1979	188.7	222.8	367.1	214.6
1980	202.1	243.2	409.4	232.4
1981	219.8	265.9	460.2	254.7
1982	238.7	287.0	528.3	279.4

[1]Fringe benefits are regarded as a package preinvestment of earnings that, together with salary, constitutes the total across-the-board compensation that institutions must pay to attract and hold competent staff. Thus, the price series for fringe benefits does not price a fixed package of benefits whose form and quality are kept constant.

[2]Personnel compensation total index based on weighted average as follows: professional salaries, 70.7 percent; nonprofessional wages and salaries, 18.3 percent; and fringe benefits, 11.0 percent.

[3]Contracted services, supplies, and equipment total index based on weighted average as follows: services, 40.56 percent; supplies and materials, 19.44 percent; equipment, 13.89 percent; books and periodicals, 9.44 percent; and utilities, 16.67 percent.

Contracted services, supplies, and equipment						Higher Education Price Index[4]	Annual percent increase over previous year
Services (4.0)	Supplies and materials (5.0)	Equipment (6.0)	Books and periodicals (7.0)	Utilities (8.0)	Total[3]		
86.9	94.7	92.5	69.9	100.3	89.8	77.7	...
88.7	94.5	93.0	73.8	100.9	91.1	80.5	3.6
90.6	94.5	93.5	78.5	100.7	92.3	83.6	3.9
92.6	95.0	94.4	84.4	100.1	93.8	86.8	3.8
94.8	95.6	95.3	90.5	99.8	95.5	90.5	4.3
96.5	97.8	97.1	96.5	99.9	97.4	95.0	5.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0	5.3
103.8	101.9	103.1	102.8	100.5	102.7	106.0	6.0
108.3	103.6	106.5	109.6	101.6	106.1	113.2	6.8
113.2	106.4	110.7	120.8	103.7	110.7	120.9	6.8
119.3	110.3	115.1	144.8	114.6	118.6	128.6	6.4
126.4	112.6	119.4	163.8	122.4	125.6	135.8	5.6
131.9	116.3	123.1	177.0	129.0	131.5	143.0	5.3
138.1	131.6	130.6	196.3	158.3	144.5	153.1	7.1
150.2	164.2	154.1	219.5	202.9	168.8	166.2	8.6
157.4	171.8	163.2	251.8	219.1	180.2	177.2	6.6
166.7	180.6	171.5	267.7	258.1	194.8	188.7	6.5
176.1	188.3	183.3	286.4	292.5	209.3	201.3	6.7
186.6	202.7	197.7	316.2	320.8	225.9	216.9	7.7
201.8	239.3	215.9	363.9	409.0	260.9	238.3	9.9
225.2	270.4	237.0	400.1	508.0	299.3	263.9	10.7
250.6	283.9	256.1	432.3	589.4	331.3	290.1	9.9

[4]HEPI based on weighted average as follows: personnel compensation, 79.3 percent; contracted services, supplies, and equipment, 20.7 percent. [See page 54 for corrections made to table III-4 weights (82.0 and 18.0 percent) to derive adjusted values used.]

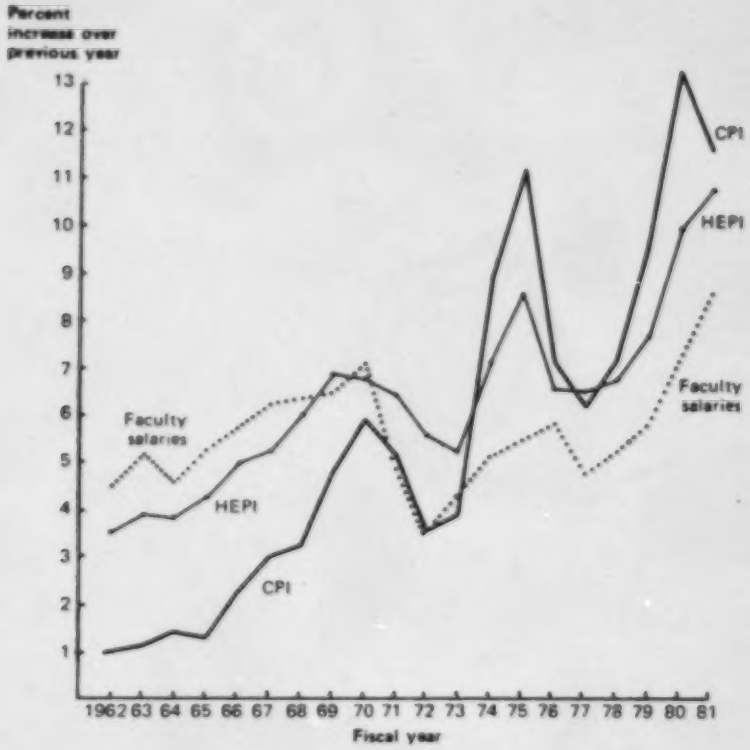
From 1961 through 1973, inflation in higher education averaged 5.2 percent a year. Since 1973, the rate of inflation has varied between 5.3 percent and 10.7 percent yearly, with a compound annual increase rate of 7.95 percent. Looking at inflation over the last 20 years reveals much about the relationship between inflation in the economy as a whole and inflation in the higher education industry. As illustrated on table I-1, and

figure I-1, pp. 14 and 16, from 1961 through 1981 inflation in the economy as measured by the CPI, inflation in higher education as measured by the HEPI, and faculty salaries all rose about equally (291, 340, and 297 respectively). Thus, over this extended period of time, the total effect of inflation was similar for the general consumer, for colleges and universities, and for faculty.

But there are great differences in the trends, as indicated by yearly inflation rates (see figure III-1). In the early 1960's, consumer prices were rising about 1 percent a year. Faculty salaries were being increased about

Figure III-1

Yearly percent changes (inflation rate) in the Higher Education Price Index, faculty salaries, and the Consumer Price Index, fiscal years 1962-1981.



5 percent a year, with inflation for institutions at 4 percent yearly. Beginning in 1965, however, consumer prices began the persistent increase to their present double digit level. Institutions, in order to curtail budget growth, counteracted the increase in prices for many goods and services by *lowering* the rate of faculty salary increase. From a high of 7 percent in 1970, faculty salary growth declined to a 4 to 6 percent yearly rate from 1971 through 1979. Even the 7.1 and 8.6 percent increases in the last 2 years were far below comparable changes in the Consumer Price Index.

The result was to pull the yearly inflation affecting colleges and universities below that experienced by the general economy. A plot of the yearly changes in the Higher Education Price Index, shown in figure III-1, crosses below that for the Consumer Price Index in 1973-74 and has, essentially, remained below ever since. By holding down faculty salaries, colleges and universities have not only experienced less inflation than the general economy since 1970, but in effect have profited by passing on their relatively moderate cost increases to the student consumer and to state and local governments. The price and cost of education relative to other goods and services has thus been lower than it would have been had no inflation occurred.

As long as faculty salary increases can be held below increases in the CPI, higher education will be a good buy compared to other goods and services. But how likely is this? Three scenarios illustrate the possibilities.

The first scenario sees an extended recession, with colleges and universities attempting to recoup faculty losses in purchasing power, and this is perhaps the most favorable forecast of the three. With declining or stabilized prices for many purchases, institutions with improved funding could afford to pass on any accrued surpluses to the faculty.

The second scenario envisions moderate inflation, with faculty salaries stabilized relative to the CPI. Faculty would neither gain nor lose in purchasing power. However, the basic reduction in salary position occurring in the 1970's would remain, making college teaching one of the lowest paid professions. Continued low pay would likely be accompanied by departures from the field, increases in second jobs, and possibly demands for greater productivity as students and other funding sources seek to pay even less for what they perceive as lower faculty quality.

The third scenario sees a continuation of past high inflation and a progressive worsening of faculty purchasing power as institutions fail to raise salaries consistent with the Consumer Price Index. If faculty were to continue to lose purchasing power at the rate experienced since 1973, this loss would be 30 percent by 1985. Such a loss would likely bring about a confrontation between faculty and those who finance higher education as to reasonable salary levels for the profession. Continuation of the past could make this date or a similar point in time an Armageddon for higher education.

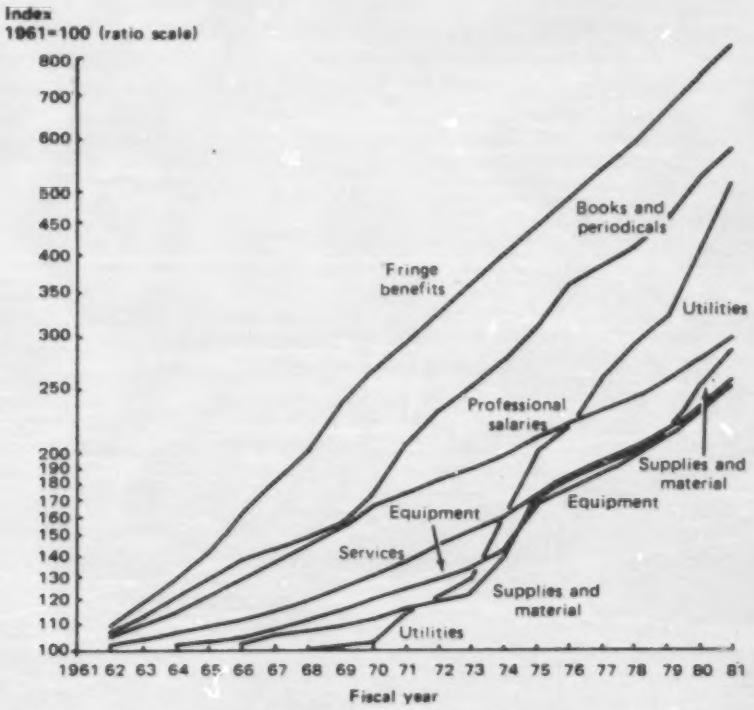
Price Trends Within Current Operations

Price trends within the HEPI are presented in table III-1 and illustrated in figure III-2. A description of each index component together with prices and data sources begins on page 50.

Taking the various HEPI components in order of their relative importance, the level of *professional salaries* (weighted 58 percent, see table III-4) paid by colleges and universities tripled between 1961 and 1981, growing steadily at a compound annual rate of increase of 5.6 percent.

Figure III-2

Comparison of trends in price change in major component subindexes of the Higher Education Price Index, fiscal years 1961-1981.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

During this same time period, the Consumer Price Index nearly tripled, with a growth rate of 5.5 percent annually. *Nonprofessional wages and salaries* (weighted 15.0 percent)—for technicians, crafts persons, clericals, students, services, and operators—grew at a slower rate than professional salaries during the sixties, but they have since caught up and now show slightly greater overall growth for the 20-year period.

Fringe benefit payments by institutions account for 9.0 percent of the educational and general budget and include expenditures for retirement, social security, and various types of insurance and compensation. As described on page 62, fringe benefits are regarded as a package preinvestment of employee earnings, with the total compensation per employee representing the "price" institutions must pay to secure and hold competent staff. If institutions contribute more to each employee's retirement, this addition is considered like a salary increase necessary to remain competitive in the labor market. Fringe benefits payments have increased 8.4 times in the last 20 years, principally as the result of a genuine effort by institutions to improve their benefit services and extend coverage to new groups of employees. Institutions have had some encouragement in this from the facts that benefits are paid out of pre-tax income rather than after-tax income and that benefit funds may be used for working capital. Other contributing factors include the increase in Federal requirements for social security payments applied to larger salary bases and the need to compensate faculty through delayed payments for their immediate low salaries.

Prices for *services* (data processing, communication, transportation, printing, etc.) purchased by colleges and universities (weighted 7.3 percent), along with prices of laboratory-type *equipment* (weighted 2.5 percent), have increased 2.6 times since 1961. The prices of supplies and materials (weighted 3.5 percent) increased 2.9 times since 1961, showing a short upward trend beginning in 1973.

Prices for *utilities* (weighted 3.0 percent) have jumped dramatically since 1970, increasing nearly 5 times over 11 years. Most of this increase reflects the prices of heating oil, which increased 11.5 times over the same period, and of natural gas, which increased 9.2 times. For institutions that heat with oil, this price increase is of greater consequence than is indicated by the HEPI composite price series for utilities, which is tempered by the somewhat less severe price increase of natural gas. In other words, depending on the fuel used for heating—oil or gas—the HEPI utilities price series either understates or overstates the inflation affecting an individual institution's utility expenditures.

The prices of *books and periodicals* (weighted 1.7 percent), which represent a high inflation cost in the college budget, have increased tremendously. The price of hardcover books increased 5 times between 1961 and 1981, and that of U.S. periodicals increased 6.6 times. In 1981 alone, the price of periodicals went up 18 percent—the largest yearly gain since the 22 percent increase between 1972 and 1973.

Deflation of Expenditures

The consequence of price changes on expenditures in higher education for the period 1961-81 is shown in table III-2 and figures III-3 and III-4.

Table III-2

Current fund educational and general expenditures[1] in institutions of higher education by institutional control, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1981.

Constant dollars in 1967 prices

Fiscal year	All institutions			
	Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]
1961[3]	$ 3,820	$ 4,916	$1,275	$1,642
1962	4,317	5,362	1,330	1,652
1963[3]	4,860	5,795	1,384	1,654
1964	5,483	6,317	1,462	1,684
1965[3]	6,370	7,039	1,524	1,684
1966	7,551	7,948	1,588	1,672
1967	8,889	8,889	1,734	1,734
1968	10,564	9,957	1,905	1,797
1969	11,873	10,489	1,971	1,741
1970	13,737	11,353	2,152	1,779
1971	15,516	12,047	2,285	1,774
1972	17,059	12,562	2,404	1,770
1973	18,825	13,174	2,619	1,833
1974	20,776	13,570	2,759	1,802
1975	22,163	13,335	2,810	1,691
1976	25,129	14,181	2,932	1,655
1977	27,197	14,413	3,236	1,714
1978	29,864	14,836	3,501	1,739
1979	32,738	15,094	3,858	1,779
1980[3]	36,369	15,262	4,226	1,773
1981[4]	40,580	15,377	4,541	1,721

[1]Excludes sponsored research, student financial aid, and mandatory transfers.

[2]Constant dollars in 1967 prices.

[3]Preliminary data.

[4]Amounts estimated.

Source: U.S. Department of Education, National Center for Education Statistics, *Financial Statistics of Institutions of Higher Education: Current Funds Revenues and Expenditures,* relevant issues.

In the public sector, total actual (current) dollar expenditures for educational and general purposes (less sponsored research) increased 12.7 times in the 20-year period. Most of this increase was necessitated by a tripling in student enrollment (table III-3)—labeled the "enrollment ef-

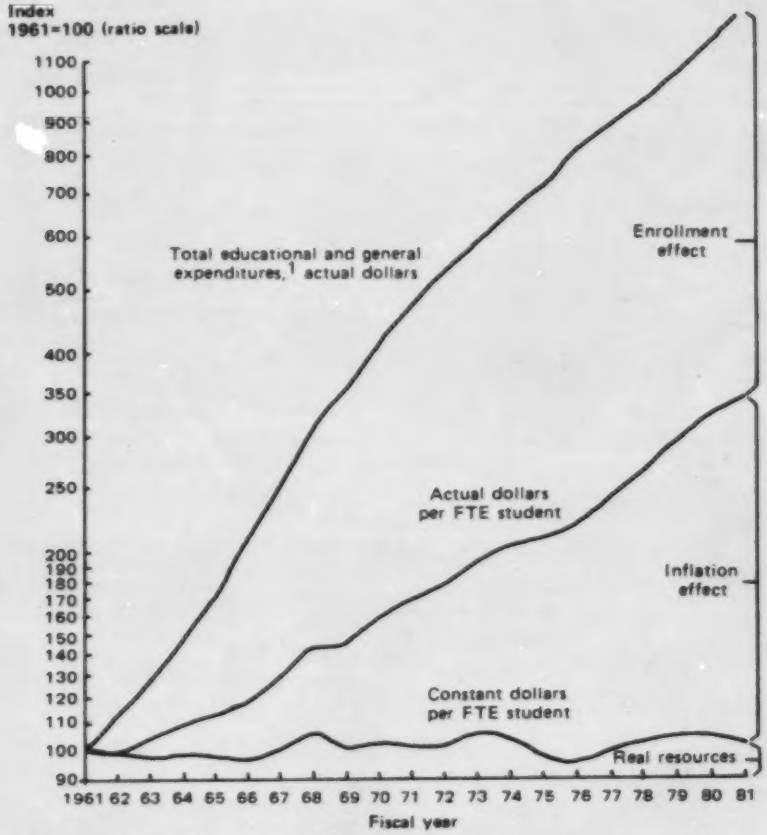
Public institutions				Private institutions			
Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]
$ 2,240	$ 2,883	$1,255	$1,615	$ 1,580	$2,033	$1,306	$1,681
2,524	3,135	1,225	1,584	1,793	2,228	1,418	1,761
2,850	3,405	1,310	1,565	2,000	2,389	1,504	1,797
3,264	3,760	1,368	1,576	2,220	2,557	1,626	1,873
3,830	4,232	1,412	1,560	2,540	2,807	1,732	1,914
4,646	4,890	1,472	1,549	2,905	3,058	1,818	1,914
5,577	5,577	1,622	1,622	3,312	3,312	1,963	1,963
6,839	6,452	1,798	1,696	3,715	3,505	2,141	2,020
7,775	6,868	1,817	1,605	4,098	3,620	2,348	2,074
9,181	7,588	1,989	1,644	4,556	3,765	2,579	2,131
10,516	8,365	2,108	1,637	5,000	3,882	2,775	2,155
11,664	8,589	2,206	1,624	5,395	3,973	2,982	2,196
12,986	9,087	2,415	1,690	5,839	4,086	3,226	2,258
14,495	9,468	2,563	1,668	6,281	4,103	3,391	2,215
15,675	9,431	2,615	1,573	6,488	3,904	3,429	2,063
17,955	10,133	2,731	1,541	7,174	4,049	3,594	2,029
19,381	10,271	3,028	1,605	7,816	4,142	3,894	2,064
21,286	10,574	3,301	1,640	8,578	4,261	4,124	2,049
23,212	10,702	3,655	1,685	9,526	4,392	4,462	2,057
25,698	10,784	3,989	1,674	10,671	4,478	4,936	2,071
28,491	10,796	4,256	1,613	12,089	4,581	5,391	2,043

fect."[1] When enrollment is taken into account, per-student expenditures in actual dollars increased from $1,255 to $4,256 (+239 percent).

[1] I am indebted to Richard Wynn for the terms "enrollment effect," "inflation effect," and "real resource," in graphically labeling changes in expenditures associated with these factors.

Figure III-3

Trends in current fund educational and general expenditures[1] in public institutions, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1981.



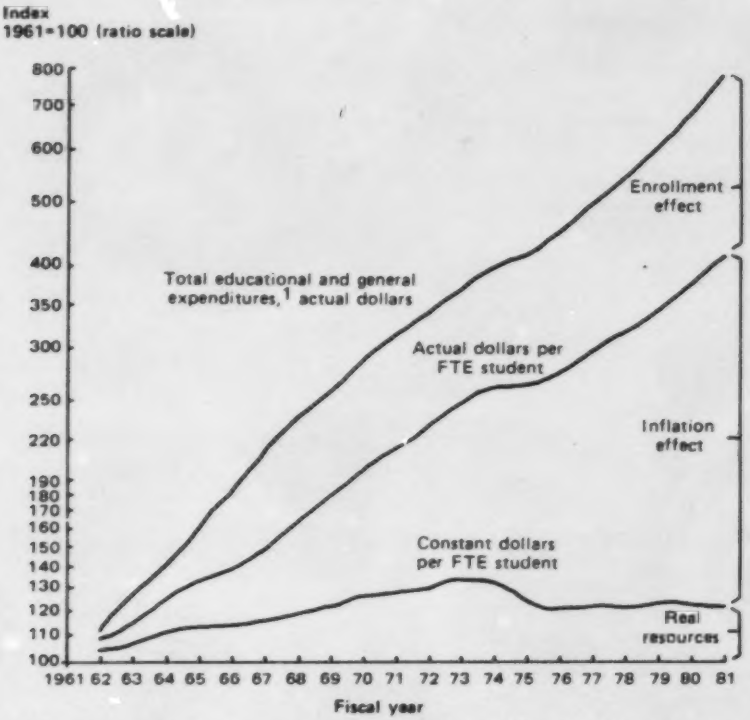
[1]Excludes expenditures for sponsored research, student financial aid, and mandatory transfers.

Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

However, at the same time a near equivalent increase in input prices occurred, the Higher Education Price Index increased from 77.7 to 263.9 (+240 percent). The consequence of this "inflation effect" on expenditures was a zero growth in "real resources" expended per student. In 1961, public institutions spent $1,615 (in constant 1967 price dollars) per

Figure III-4

Trends in current fund educational and general expenditures[1] in private institutions, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1981.



[1]Excludes expenditures for sponsored research, student financial aid, and mandatory transfers.

Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal distances reflect equal proportional (as distinguished from absolute) changes.

FTE student for current educational and general operations. Two decades later (1981) the constant amount was $1,613. Thus, the 12.7 fold increase in total expenditures by public colleges and universities was completely absorbed by rising enrollments and institutional costs.

Public higher education has been a constant input industry, with colleges and universities having exactly the same real dollar support year after year. Unlike most other industries, higher education has not received any additional dollars to improve quality even though it needs to make additional investments for modernization and to maintain competitive position. In the last two decades, colleges and universities have

Table III-3

Full-time-equivalent enrollment in institutions of higher education by institutional control, fiscal years 1961-1981.

Fiscal year	All institutions	Public	Private
1961	2,995,000	1,785,000	1,210,000
1962	3,245,000	1,980,000	1,265,000
1963	3,505,000	2,175,000	1,330,000
1964	3,750,459	2,385,667	1,364,792
1965	4,178,784	2,712,449	1,466,335
1966	4,753,872	3,155,527	1,598,345
1967	5,126,005	3,438,534	1,687,471
1968	5,539,222	3,804,264	1,734,958
1969	6,024,199	4,279,172	1,745,027
1970	6,382,618	4,615,935	1,766,683
1971	6,790,509	4,988,573	1,801,936
1972	7,096,444	5,287,197	1,809,247
1973	7,186,865	5,377,200	1,809,665
1974	7,529,434	5,677,353	1,852,081
1975	7,886,565	5,994,876	1,891,689
1976	8,570,087	6,574,162	1,995,925
1977	8,406,990	6,400,177	2,006,813
1978	8,529,415	6,449,430	2,079,985
1979	8,485,086	6,350,541	2,134,545
1980	8,605,506	6,443,399	2,162,107
1981	8,936,650	6,694,193	2,242,457

Note: Enrollment includes resident and extension degree and nondegree-credit. Full-time-equivalent (FTE) enrollment equals full-time enrollment plus one-third part-time and extension enrollment.

Source: U.S. Department of Education, National Center for Education Statistics, *Opening (fall) Enrollment in Higher Education.*

substantially increased their use of technology, particularly administrative computer support, sustained a greater administrative overhead load largely due to Federal requirements, and in some instances provided additional student and community services. Funding these improvements may have required annual support increases of 1 to 3 percent, yet no additional real resources have been available. Colleges and universities managed these improvements by reducing budgets in other areas, possibly instruction, and elsewhere improving the "efficiency" of their operations. Faculty and administrative salaries have been kept at an absolute minimum, with the potential if not actual loss in quality as faculty increasingly recognize alternative employment opportunities.

The private sector has fared slightly better, showing a 22 percent gain in real resources expended per student for the 20-year period.

Enrollments in the private sector increased 85 percent from 1961 to 1981, far less than the nearly 200 percent increase in the public sector. And when coupled with a 7.65-fold increase in total expenditures, the per-student increases more than offset the rise in prices. Thus, in terms of constant (1961) dollar input, unit expenditures in the private sector rose from $1,681 per FTE student in 1961 to $2,043 in 1981. In 1981 dollars, the 1981 expenditures of $5,391 per student[2] compares with $4,436 spent in 1961, an increase of $955 per student.

The implication of a near constant or slight growth in real resource input per student for the quality of education provided is not clear. Certainly it is true that both the inputs and outputs of higher education have not remained constant, which prevents rigid application of a fixed input price deflator. The education "product" of today is simply not the same as that of 20 years ago. Neither are the inputs. More attention is now being given graduate education and other special training and service that are fundamentally more costly than the standard undergraduate program. More sophisticated and costly equipment is also being used. Thus, higher education today is different and inherently more costly than it was two decades ago, independent of any inflationary factors. Yet with the

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[2]Consistent with the limited intent of this report, this brief outline of data serves primarily to illustrate the use and value of price deflators in analyzing higher education expenditures. For extended interpretive studies of college and university financing with consideration given to real resource employment, see the following works.

In a very thorough study of resource use in higher education, June O'Neill identifies trends in constant dollar expenditures in the public and private sectors similar to those presented here. Beginning with academic year 1955-56 and extending through 1966-67, the O'Neill data show instructional expenditures per credit hour in constant dollars in the public sector remaining essentially steady at $33 per credit hour. In the private sector, instructional expenditures rose from $37 per credit hour in 1955-56 to $44 in 1966-67. See June O'Neill, *Resource Use in Higher Education*, Carnegie Commission on Higher Education, Berkeley, Calif., p. 41.

In a series of excellent interpretive studies, Hans Jenny and Richard Wynn trace the pattern in real resource growth for 48 private liberal arts colleges. The general prosperity of the early and middle 1960's is reported in *The Golden Years*, with only a hint in 1967 and 1968 of impending financial problems. Only 2 years later, *The Turning Point* documented the end of the golden years, with income unable to keep pace with accelerating expenditure growth. A third report by Wynn reviews the entire period from fiscal year 1964 through 1973, showing educational and general expenses per student in constant dollars peaking in 1971 and then gradually declining. See G. Richard Wynn, *At the Crossroads*, Center for the Study of Higher Education, School of Education, The University of Michigan, Ann Arbor, April 1974, 33 pp. See also Wynn, "Inflation in the Higher Education Industry," *Professional File*, Vol. 6, No. 1, January 1975, National Association of College and University Business Officers, Washington, D.C.

In a chapter on the status and issues of financing higher education, I devote 10 pages to an analysis of the patterns and trends of institutional financing. The data, by five student education expenditure categories and five related income sources, are presented separately for public and private universities, 4-year colleges, and 2-year colleges for fiscal years 1969 through 1972. Needless to say, continuous updating of this information is critical to understanding the real investment in higher education among the different types of institutions and the changing roles and relative contribution of the various income sources. See D. Kent Halstead, *Statewide Planning in Higher Education*, U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C., 1974, pp. 539-548 and appendix C.

exception of a modest increase in the private sector, increased funding in constant dollars per student has not occurred. Possibly the consequence has been a lowering of quality in those programs where resources have been reduced and shifted to expanding more costly academic endeavors.

Hopefully, the need for more real resources has been met by improving the effectiveness and efficiency of educational operations. During this current period of financial difficulty, college and university officials have undoubtedly taken many positive steps to curtail extravagance and effect true cost savings to enable fixed resources to be reallocated without serious quality deterioration. However, without accurate measures of the outputs of education, no precise measure can be made of the degree to which cost savings have been effected to offset greater resource requirements. It remains for each individual institution to constantly struggle with and balance the increasing costs of new programs with cost-saving efficiency so as to avoid any deterioration in quality.

Description of Index and Data Base

The complete title of the index presented in this chapter is: Index of Change in Prices of Goods and Services Purchased by Colleges and Universities Through Current Fund Educational and General Expenditures Excluding Sponsored Research. For the sake of brevity, it is referred to as the Higher Education Price Index (HEPI). The HEPI and its major component subindexes for fiscal years 1961-81 are presented in table III-1, page 38. The HEPI is concerned with price changes involving the salaries of faculty, administrators, and other professional personnel, nonprofessional salaries and wages, various services, supplies and materials, equipment, books and periodicals, and utilities—all of which represent goods and services purchased by colleges and universities making current fund expenditures for educational and general purposes.

Educational and general operations are classified in the following functional categories: instruction and departmental research, extension and public service, educational programs such as workshops and instructional institutes supported by sponsors outside the institution, student services, general administration and general institutional expenses, staff benefits, libraries, operation and maintenance of physical plant, and organized activities of educational departments designed primarily to provide instructional or laboratory training of students. Sponsored research and other separately budgeted research, although part of educational and general operations, is excluded from the index compilation and priced separately by a Research and Development Price Index (R&DPI). The goods and services priced by the HEPI represent those that are purchased to perform all of the above functions.

The Higher Education Price Index is a weighted aggregative index number with "fixed," or "constant," weights, often referred to as a

"market basket" index. The HEPI measures price change by repricing each year and comparing the aggregate costs of the goods and services bought by colleges and universities in a selected base period. The quantities of these goods and services have been kept constant based on the 1971-72 buying pattern of colleges and universities. (Prior to 1967 the index weighting is based on the 1964-65 expenditure pattern of institutions.) The quantities represent not only annual consumption of the specific sample items actually priced by the index, but also consumption of related items for which prices are not obtained, so that the total cost of the market basket represents total institutional spending for goods and services.

The index is calculated on the reference base of fiscal year 1967 = 100. This means that current prices are expressed as a percentage of prices for 1967. An index of 110 means that prices have increased 10 percent since the base period; similarly, an index of 90 means a 10 percent decrease. The index can be converted to any desired base period by dividing each index number to be converted by the index for the desired base period.

Index Weighting Structure

The composition of current fund educational and general expenditures (excluding sponsored research) by object classification used for computing the Higher Education Price Index is shown in table III-4. Personnel compensation comprised 82.0 percent of educational and general expenditures of institutions of higher education in the United States in 1971-72. The largest expenditures for personnel compensation were for faculty salaries (42.2 percent), fringe benefits (9.0 percent), administration and institutional service personnel salaries (8.5 percent), clerical wages and salaries (5.4 percent), and nonprofessional service worker wages (4.0 percent). Contracted services, supplies, and equipment, which accounted for 18.0 percent of the total educational and general budget, consisted primarily of expenditures for services (7.3 percent), supplies and materials (3.5 percent), and utilities (3.0 percent).

The annual detailed consumption pattern represented in the index is based predominantly on the 1971-72 buying patterns of those few colleges and universities in the United States that classify their expenditures by object group; i.e., salaries, supplies and material, communication, equipment, and the like. In particular, prime data sources were the expenditure records of the University of Wisconsin System and the Oklahoma State Regents for Higher Education. The extensive object classification of expenditures from these two sources was used to establish the HEPI's detailed subdivision weightings. The breakdown of expenditures for professional salaries by occupational groupings was based on a professional employee count (multiplied by average salaries)

Table III-4

Composition by object category of current fund educational and general expenditures in colleges and universities, estimate for fiscal year 1972.[1]

Category	Percent of total expenditures	
Personnel compensation		82.0
1.0 Professional[2] salaries	58.0	
1.1 Faculty	42.2	
1.3 Graduate assistants	2.7	
1.5 Extension and public service personnel	2.6	
1.6 Administration and institutional services personnel	8.5	
1.7 Library personnel	2.0	
2.0 Nonprofessional wages and salaries	15.0	
2.1 Technicians	1.5	
2.2 Craftsmen	1.0	
2.3 Clerical	5.4	
2.4 Students	2.0	
2.5 Service	4.0	
2.6 Operators and laborers	1.1	
3.0 Fringe benefits	9.0	
Contracted services, supplies, and equipment		18.0
4.0 Services	7.3	
4.1 Data processing and equipment rental	1.4	
4.2 Communication	1.5	
4.3 Transportation	.7	
4.4 Printing and duplication	.5	
4.5 Miscellaneous services	3.2	
5.0 Supplies and materials	3.5	
6.0 Equipment	2.5	
7.0 Books and periodicals	1.7	
8.0 Utilities	3.0	
	100.0	100.0

[1]Excluding expenditures for sponsored research.

[2]Professional categories 1.2, "research associates," and 1.4, "other professional, nondoctoral," are R&D personnel associated with sponsored research expenditures, which are excluded.

obtained from the U.S. Office of Education 1970-71 Higher Education General Information Survey (HEGIS). A similar subdivision of nonprofessional salaries by occupation was computed using a nonprofessional employee count conducted in 1971 by the Office of Institutional Research, State University of New York. In a few instances, U.S. Department of Labor, Bureau of Labor Statistics Producer Price Index weights were used within certain object classes when no institutional data

were available, e.g., the division between expenditures for telephone and postal charges within the communication category.

The weights for larger divisions were established from data in the annual reports of a number of public and private colleges and universities classifying expenditures by broad object categories. U.S. Office of Education payroll expenditure data were used to set the major division between expenditures for personnel compensation and for contracted services, supplies, and equipment. The relationship between salary and fringe benefit expenditures was determined from the American Association of University Professors' 1971-72 annual survey.

The object category weights shown in table III-4 are estimated national averages based on limited institutional data. The estimates only approximate actual national values. Furthermore, the expenditure patterns of individual institutions differ markedly from these averages. Such variance in weighting, however, has no great effect on the applicability of the HEPI to any given institutional situation[3] or on the validity of index numbers themselves. Index validity depends primarily on selecting suitable price series and holding budget weights constant. Modest differences in the weights attached to expenditure categories have little effect on overall index values. This is because the HEPI is dominated by the trend in faculty salaries and because of similarity in the salary trends for other personnel hired by institutions. Even a substantial difference in weighting does not have too great an effect on index values. An error in budget weights of 2 percent involving a price differential of 5 percent results in a difference in overall price index values of 0.10. Thus, if the weight of an item inflating at the rate of 9 percent is erroneously assigned a budget weight of 6 percent rather than the correct 4 percent, and if the 2 percent weight correction is transferred to items inflating at the rate of 14 percent, the overall index value will change by 0.1, from 106.2 to 106.3 for example.

A fixed weight index such as the HEPI occasionally requires revision of the weights assigned various items if the index is to accurately reflect current goods and services being purchased. Such revisions should be relatively infrequent since even small changes in the composition or quality of the goods and services being purchased prevent unambiguous comparisons of price alone without intangible considerations. New weights, when necessary, may be introduced periodically by a process of

[3]Individual institutions or groups of institutions may, of course, design their own educational and general expenditure index using the price series provided in this publication and weighting the various items according to their own distinct expenditure pattern. Values for such tailored indexes will differ from the HEPI on a yearly basis, but the cumulative difference between a local and the national index should be relatively small, i.e., the long-term trend in prices for an individual institution approaches that of the national average. (See page 54 for example of a specialized index for AAUP category institutions.) However, it is relatively easy to construct a special index using the institution's own salary data and published price series for other items, and the gain in validity for specialized years for a given college may make the exercise worthwhile.

"linking," without affecting the index level. The linking process has been used in a weight revision for the two major components of the HEPI—personnel compensation and contracted services, supplies, and equipment. For fiscal years 1961 through 1972, these two components are weighted 74 percent and 26 percent, respectively, based on the 1964-65 budget pattern of colleges and universities. For fiscal years 1972 through 1981, the weights are 79.3 and 20.7 percent, respectively, based on a physical count change in items purchased as indicated by an analysis of the 1971-72 budget.

In 1971-72 the budget of institutions showed an increase in the relative expenditures for personnel compensation to 82 percent and a corresponding decrease in the proportion spent for contracted services, supplies, and equipment to 18 percent. This change was due partly to the fact that salaries and fringe benefits have increased at a faster rate than the prices of contracted services, supplies, and equipment. Also, in efforts to economize, institutions have cut back on outside purchases to concentrate limited funds on faculty salaries and instruction. This action decreased the amounts of contracted services, supplies, and equipment purchased relative to the number of faculty and staff employed. In reweighting index components, only this type of change in consumption is taken into account. The effects of price change must be excluded.

For fiscal years 1972 through 1981, the 1971-72 budget proportions have been adjusted to index weighting factors of 79.3 for personnel compensation and 20.7 percent for services, supplies, and equipment. This adjustment properly excludes the effects of price change and accounts only for changes in the consumption pattern of colleges and universities, i.e., their purchase of different relative physical quantities of goods and services. Budget proportions represent not only the relative physical count of items purchased, but also their price. The adjustment made relates the 1972 to the 1965 budget in terms of implied physical quantity changes excluding price factors. If the 1972 budget proportions were used as unadjusted weighting factors, index values after 1972 would tend to overstate the rate of inflation. The theory and calculations involved in this adjustment are presented in an earlier section, "Adjustments for Quantity Changes," pages 26-31.

Index Prices and Data Sources

The list of items priced by the HEPI includes the most important services and goods purchased by colleges and universities for educational and general purposes, and a sample of the less important ones. In combination, these represent all items purchased. This section presents a description of the items priced for the index and data sources. It should be kept in mind that the essential objective in pricing is to maintain constant quality in the item being observed or exclude those differences in price attributable to changes in product or service quality.

PERSONNEL COMPENSATION

1.0 Professional salaries

Subindexes for salaries of the various professional personnel categories are shown in table III-5. The five components—faculty, graduate assistants, extension and public service personnel, administration and institutional services personnel, and library personnel—are discussed below.

1.1 Faculty

The faculty salary subindex consists of a weighted average of individual indexes of the salaries of professors, associate professors, assistant professors, and instructors as shown in table III-6. The weights are based on the proportion of total faculty salaries paid to each academic rank in 1971-72 as follows: professors, 34.5 percent; associate professors, 25.2 percent; assistant professors, 30.2 percent; and instructors, 10.1 percent.

The source of all faculty salary data is the *Annual Report on the Economic Status of the Profession,* published by the American Association of University Professors (AAUP) based on data collected by the National Center for Education Statistics. In 1980-81, 2,595 institutions participated in the survey. In 1960-61, only 452 institutions participated. To infer national averages from this low earlier survey participation is a rather extreme extrapolation, and the validity of index values for this period may legitimately be questioned on this basis.

In 1965-66, the AAUP began publishing salary increases for the *same* institutions reporting comparable data for 1-year periods. While this price series would provide a better indication of changes in salary than do unadjusted data for the *total* number of institutions reporting, as a practical matter the differential between the two trends is extremely small (approximately 1.1 percent for the 7-year period 1964-65 to 1971-72). Beginning in 1981, salary data for *all* reporting institutions are presented.

Comparison of rates of salary and fringe benefits change among institutions by type and control reveals differences that might warrant computation of separate price indexes for certain groups of institutions. The following table (page 56) shows the 9-year (FY 1971 to FY 1980) percent increase in faculty salaries and fringe benefits for 10 groups of institutions according to the AAUP classification system. Also shown are HEPI values using indexes for faculty salaries and fringe benefits for each type of institution.

The range of faculty salary and fringe benefit changes has a significant long-term differential effect on the inflation affecting the various types of institutions. Whereas public category IIB institutions sustained 93.8 percent inflation between fiscal years 1971 and 1980, private IIA colleges

		Faculty salary Change	Fringe benefits	Specialized HEPI Change
All institutions	(HEPI)	58.4%	154.5%	85.3%
Public, category	I	57.6	168.5	86.3
	II A	60.2	211.6	91.1
	II B	68.0	205.9	93.8
	III	58.7	130.5	83.4
Private, category	I	59.0	111.0	81.8
	II A	53.4	94.2	78.1
	II B	59.6	136.2	84.3
Church related	I	61.1	123.3	83.8
	II A	59.6	113.0	82.2
	II B	51.3	114.4	79.0

AAUP institutional type category descriptions:

Category I includes institutions that offer the doctorate degree and that conferred in the most recent 3 years an annual average of 15 or more earned doctorates covering a minimum of three nonrelated disciplines.

Category IIA includes institutions awarding degrees above the baccalaureate but not included in Category I.

Category IIB includes institutions awarding only the baccalaureate or equivalent degree.

Category III includes 2-year institutions with academic ranks.

had 78.1 percent inflation when those institutions' salaries and fringe benefits were substituted in the HEPI. While these differences appear to warrant calculation of separate indexes for at least some types of institutions, financial support and personnel resources are not presently available to collect the specialized budget mix information necessary to establish the unique price index weighting patterns for each type of institution. Further, obtaining specialized price series for some components such as administrative salaries, library acquisitions, etc., is both difficult and costly. In veiw of these difficulties, and the fact that the Higher Education Price Index provides an adequate general indication of overall inflation in the higher education industry, no specialized index computation is currently published.

1.3 Graduate assistants

There is no salary series for graduate student teaching assistants (T.A.'s) and research assistants (R.A.'s), and a suitable proxy to present the trend in their salaries is difficult to select. Policy and practice in compensating graduate assistants vary, and these are dependent on a number of factors and subject to various restraints.[4] Despite this complexity, all institutions recognize the graduate assistant position as a secondary but supportive activity to the student's principal academic pursuits.

Three considerations appear to underlie the setting of assistant salary levels: (1) part-time earnings of graduate students are used primarily to support the individual while attending college and should therefore be adjusted for cost-of-living increases, (2) payment received for research by graduate students that contributes to their academic progress may be regarded as a scholarship or grant and should consequently correspond to tuition charges, and (3) the graduate assistant, as a bona fide and contributing member of the academic community and an adjunct of the faculty, should be compensated proportionate to and consistent with faculty salary schedules.

Based on evidence that these considerations are basic to the establishment of graduate assistant salary policy, a proxy salary series was calculated giving equal weight to cost-of-living as indicated by the Consumer Price Index, tuition charges, and instructor salaries. The price trend for the resulting composite index proved to be, for all practical purposes, equivalent to the trend in instructor salaries alone. As a result, instructor salaries at universities (which employ about 85 percent of all junior faculty) is used as a proxy for the price series for graduate assistants.

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[4]Some departments with national reputations vie for outstanding graduates by offering top salaries. Such open competition is difficult, however, at universities that have adopted institution-wide standard salary schedules. In setting graduate assistant salary levels, institutions vary in their attention to the tax exemption status of certain assistant earnings that the Internal Revenue Service considers a statutory scholarship if the reimbursement is for work performed to partial fulfillment of a degree. Some institutions, in seeking to discourage lucrative teaching and research assistantships, contribute to what is termed the "Ph.D. stretchout"—lengthening the time spent by students earning their graduate degree—by keeping assistant salaries at a minimum. In addition, institutions seeking to curtail enrollments in fields where a labor surplus is thought to exist may employ a minimum wage policy.

Graduate student assistant salary levels are also under certain restraints. If the earnings of part-time T.A.'s and R.A.'s approach those of full-time instructors and research associates, faculty and research directors may seek greater employee productivity by substituting instructors for student assistants. Also, since the activities of graduate assistants (particularly R.A.'s) frequently contribute directly to their academic progress, as in thesis preparation, assistant salaries must remain below those of other less academically supportive positions available to graduate students such as instructor. Additionally, graduate assistant salaries must be lower than labor market earnings of newly hired bachelor degree holders to discourage a massive increase in assistant applicants who believe they can earn as much continuing their education as working in the economy.

Table III-5

Indexes of salaries of professional personnel used for the Higher Education Price Index, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in table III-4.)**

Fiscal year	Faculty (1.1)	Graduate assistants (1.3)	Extension and public service personnel (1.5)
1961	73.5	76.0	73.5
1962	76.8	78.4	76.8
1963	80.8	82.4	80.8
1964	84.5	86.2	84.5
1965	89.0	90.2	89.0
1966	94.1	93.6	94.1
1967	100.0	100.0	100.0
1968	106.4	105.9	106.4
1969	113.3	112.8	113.3
1970	121.3	120.2	121.3
1971	127.2	125.8	127.2
1972	131.7	132.4	131.7
1973	137.4	136.8	137.4
1974	144.4	142.8	144.4
1975	152.3	151.0	152.3
1976	161.1	160.9	161.1
1977	168.7	169.7	168.7
1978	177.6	178.5	177.6
1979	187.9	188.9	187.9
1980	201.3	198.6	201.3
1981	218.6	217.8	218.6
1982	236.9	231.6	236.9

[1]Professional salaries total index based on weighted average as follows: faculty, 72.76 percent; graduate assistants, 4.66 percent; extension and public service personnel, 4.48 percent; administration and institutional services personnel, 14.66 percent; and library personnel, 3.44 percent.

1.5 Extension and public service personnel

Extension and public service activities are designed primarily to serve the general public rather than enrolled students. These services include adult study courses, community development, conferences and institutes, evening schools, correspondence study, radio and TV services, film library, and consultation to state and local government.

Administration and institutional services personnel (1.6)	Library personnel (1.7)	Professional salaries total[1] (1.0)	Fiscal year
71.9 est.	69.1 est.	73.2	1961
76.3	74.1	76.7	1962
80.1 est.	77.3 est.	80.7	1963
84.5	80.6	84.4	1964
89.1 est.	86.7 est.	89.0	1965
94.6	92.8	94.1	1966
100.0 est.	100.0 est.	100.0	1967
106.9	107.2	106.5	1968
114.6 est.	114.6 est.	113.5	1969
122.3	121.9	121.4	1970
129.2 est.	128.5 est.	127.5	1971
135.8	135.1	132.5	1972
143.3 est.	142.2 est.	138.4	1973
150.8	149.4	145.4	1974
160.7 est.	157.1 est.	153.6	1975
163.8	165.0	161.6	1976
171.4 est.	171.1 est.	169.2	1977
179.5	177.7	177.9	1978
192.0	192.0	188.7	1979
206.5	206.8	202.1	1980
225.7	224.7	219.8	1981
248.7	246.3	238.7	1982

By far the largest proportion of teachers for extension and continuing education are from an institution's own staff: 80 percent for credit courses, 63 percent for noncredit courses, and 54 percent for conferences, institutes, and workshops. Institutional staff teaching extension and continuing education courses are paid generally according to a fixed scale and, to a lesser extent, according to individual negotiations

Table III-6

Indexes and dollar amounts of faculty salaries[1] by rank, all institutions, fiscal years 1961-1982.

1967 = 100 (Number code in parentheses identifies category as outlined in table III-4.)

Fiscal year	Professors		Associate professors	
	Amount	Index	Amount	Index
1961	$10,344	71.8	$ 7,949	73.4
1962	10,868	75.4	8,309	76.7
1963	11,399	79.1	8,752	80.8
1964	12,017	83.4	9,127	84.3
1965	12,715	88.3	9,623	88.9
1966	13,505	93.8	10,186	94.1
1967	14,402	100.0	10,829	100.0
1968	15,341	106.5	11,530	106.5
1969	16,312	113.3	12,296	113.5
1970	17,374	120.6	13,066	120.7
1971	18,314	127.2	13,792	127.4
1972	18,913	131.3	14,266	131.7
1973	19,751	137.1	14,887	137.5
1974	20,798	144.4	15,641	144.4
1975	21,870	151.9	16,495	152.3
1976	23,233	161.3	17,449	161.1
1977	24,325	168.9	18,269	168.7
1978[3]	25,030	177.7	18,900	177.8
1979	26,420	187.6	20,035	188.5
1980	28,560	202.8	21,430	201.6
1981[4]	30,870	220.1	23,290	219.5
1982	33,480	238.7	25,210	237.6

[1]Average salary for full-time faculty based on standard 9-month academic year.

[2]Faculty total index for all institutions (HEPI 1.1) is a weighted average based on the proportion of total faculty salaries paid to each academic rank in 1971-72 as follows: professors, 34.5 percent; associate professors, 25.2 percent; assistant professors, 30.2 percent; and instructors, 10.1 percent.

[3]Beginning in 1978 faculty salaries and fringe benefits are based on a substantially larger sample so that the FY 78 dollar amount data are not comparable to earlier years. However, the FY 78 indexes are based on a constant sample of institutions reporting comparable data for both FY 77 and 78, and therefore continue the index series without distortion.

[4]Beginning in 1981, salaries are for all reporting institutions rather than the slightly smaller universe of institutions reporting comparable data in succeeding years. The 1981 data are linked to previous series in 1980.

Source: American Association of University Professors, *Annual Report on the Economic Status of the Profession.*

Assistant professors		Instructors		Faculty total index[2] (1.1)
Amount	Index	Amount	Index	
$ 6,676	74.7	$ 5,428	76.2	73.5
6,960	77.8	5,647	79.3	76.8
7,318	81.8	5,934	83.3	80.8
7,626	85.3	6,165	86.6	84.5
7,980	89.3	6,442	90.5	89.0
8,429	94.3	6,737	94.6	94.1
8,941	100.0	7,122	100.0	100.0
9,516	106.4	7,548	106.0	106.4
10,130	113.3	8,010	112.5	113.3
11,015	123.2	8,541	119.9	121.3
11,347	126.9	9,084	127.5	127.2
11,765	131.6	9,520	133.7	131.7
12,289	137.4	9,873	138.6	137.4
12,872	144.0	10,344	145.2	144.4
13,578	151.9	11,005	154.5	152.3
14,336	160.3	11,607	163.0	161.1
15,010	167.8	12,153	170.6	168.7
15,460	176.7	12,490	179.8	177.6
16,370	187.1	13,205	190.1	187.9
17,470	199.7	14,070	202.5	201.3
18,980	217.2	15,150	215.1	218.6
20,630	236.1	16,310	231.6	236.9

based on the going rate of the profession, anticipated income of the program, and preparation and travel time of the lecturer.[5]

The National University Continuing Education Association has surveyed and published salary data for extension and continuing education administrative positions. However, no salary data are available for faculty participating in these programs. In the absence of such data, it is assumed that the fixed scale of payment to an institution's own staff teaching extension and continuing education courses parallels faculty salaries for resident instruction. On this basis, AAUP salary data for faculty are used as a proxy for the price series for extension and public service personnel.

1.6 Administration and institutional services personnel

Administration and institutional services personnel salaries for the period 1960-61 through 1971-72 are based on median annual salaries of 10 administrative officer positions in 4-year institutions surveyed by the National Education Association.

This series for 1971-72 to the present is based on a mean salary value for 18 administrative positions reported by approximately 960 institutions responding to the annual Administrative Compensation Survey of the College and University Personnel Association (CUPA).[6] The mean salary for each position is presented in table III-7. Administrative positions normally associated with auxiliary enterprise operations, such as director of food services, student housing, student union, athletics, and bookstore manager, are excluded. Also excluded is the position of Director, affirmative action, which was added to the CUPA survey in 1978-79.

At 4-year and 2-year colleges, salary payments for the administrative positions surveyed by CUPA account for a large portion of total expenditures for this subindex item. Even though universities have more nonacademic positions—because of larger staffs in institutional development and student services—it is assumed that the price changes for these additional positions parallel those in the price series for the administrative officers used. It should be noted that the price series trend for faculty and administrative personnel are similar (see table III-5); therefore, any error in weighting between the two items is of little consequence to overall HEPI values.

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[5]National University Extension Association, *Annual Survey of Extension and Continuing Education in NUEA Member Institutions, 1969-70: Administration, Financing and Admissions Policies*, Washington, D.C., 1971, pp. 1, 26. National University Continuing Education Association, which replaced the National University Extension Association, has not updated this survey.

[6]CUPA data are now used in preference to the NEA data because of the additional positions and coverage of 2-year institutions included in the former's survey. The salary data for the two organizations are linked in 1971-72.

1.7 Library personnel

Salary data for various library positions do not exist. As a proxy price series for all positions, the salary of head librarians is used—mean values reported by the College and University Personnel Association (1971-72 to present), and median values reported by the National Education Association (1960-61 through 1972-73). The two salary series are linked in 1971-72. These data are presented in table III-5.

2.0 Nonprofessional wages and salaries

The salary subindexes for nonprofessional occupations are presented in table III-8 and discussed below.

For nonprofessional categories, it is assumed that salaries paid by colleges and universities are determined primarily by competition in the open labor market. Although the absolute wages paid to nonprofessionals by colleges may be lower than those paid outside the industry, the relative change from year-to-year is probably the same for all sectors. Hence, the price series for the various occupations for all employees is applicable to colleges and universities.

2.1 Technicians

Technicians are involved in skilled work at a level requiring knowledge and formal training such as that obtained at technical institutes, 2-year colleges, and technical specialist training programs at universities. Examples of various types of technicians are: engineering laboratory, medical X-ray, dental, optical, cartographic, museum, and histology. The technician category also includes electronic data processing (EDP) personnel.

The salary data used for engineering technicians and draftsmen are collected by the Bureau of Labor Statistics (BLS) and reported in the *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC). EDP personnel salaries are from survey data collected by the periodical *Infosystems.*

2.2 Craftsmen

For the craftsmen category, fixed weight composite of average weekly earnings for eight skilled maintenance and toolroom occupations (carpenters, electricians, machinists, mechanics, mechanics-automotive, painters, pipefitters, and tool and die makers) collected by the Bureau of Labor Statistics and reported in *Area Wage Survey* is used as the price series for the 1961-1977 period. Beginning in 1977 and linked to the earlier series, the BLS Employment Cost Index (ECI) for craft and kindred workers is used.

Table III-7

Annual salaries of administrative officers in colleges and universities, fiscal years 1960-1982.

	1958-60	1961-62	1963-64	1965-66	1967-68	1969-70
Index number (1966-67 = 100)	68.3	76.3	84.5	94.6	106.9	122.3
Mean for all positions	$ 9,117	$10,181	$11,282	$12,624	$14,271	$16,323
Chief executive officer (pres), single institution	13,827	15,375	17,330	19,638	22,203	25,979
Chief academic officer						
Registrar	6,340	7,312	8,142	9,123	10,386	11,743
Director of admissions	7,680	8,636	9,572	10,364	12,983	
Director, computer center						
Chief business officer	8,536	9,405	10,512	11,780	14,914	17,615
Director, purchasing						
Director, personnel/ human resources						
Director, physical plant						
Comptroller						
Chief development officer						
Chief public relations officer	7,194	7,669	8,440	9,596	10,823	12,764
Director, information office						
Chief student affairs officer						
Director, student placement						
Director, student financial aid						
Director, student counseling						
Director, affirmative action, equal employment						
Vice-president	14,154	16,000	17,130	19,012	21,458	23,250
Dean of the college	10,723	12,230	13,644	15,703	16,141	19,125
Dean of students	8,796	9,582	10,694	12,027	14,086	16,050
Dean of men	7,280	8,202	9,144	9,783	10,983	12,319
Dean of women	6,838	7,389	8,216	9,209	10,289	11,406

[1]Index compilation excludes new position of Director, affirmative action.

Note: Salary data are for full-time employees based on 12 months of service and exclude fringe benefit payments. Individual position salaries are median values in 4-year institutions, 1960-72; mean values for the same 2-year and 4-year institutions reporting comparable data, 1972-82. Excluded are administrative positions for auxiliary

1971-72	1973-74	1975-76	1977-78	1978-79	1979-80	1980-81	1981-82
135.8	150.8	163.8	179.5	192.0[1]	206.5	225.7	248.7
$17,215	$19,112						
$18,127		$20,763	$22,752	$24,222	$26,054	$28,481	$31,379
29,805	32,612						
29,750		35,337	39,436	41,023	44,846	48,627	53,292
23,771	26,308	28,161	31,046	33,188	35,535	38,505	42,671
14,373	15,896						
13,108		17,877	18,901	19,734	21,452	23,568	25,827
15,178	16,919						
14,280		18,972	20,415	21,329	23,142	24,979	27,669
17,119	19,212	20,613	22,389	24,166	25,899	28,198	30,988
21,387	23,862						
19,419		25,372	28,081	30,535	32,670	35,944	39,886
13,119	14,580	16,309	17,696	19,295	20,585	22,788	24,642
15,317	17,565	18,695	21,082	23,309	25,259	27,847	30,736
15,039	16,840	18,251	20,485	21,862	23,860	26,135	28,887
16,537	18,528	19,707	22,257	23,810	25,400	28,019	30,577
19,961	21,561	23,585	26,353	27,938	29,883	32,794	36,223
15,892	17,484						
14,652		19,293	20,884	21,375	22,909	26,263	28,653
13,211	14,977	16,276	17,951	20,017	20,864	22,986	26,221
19,356	21,320	22,931	24,667	27,008	29,203	31,729	35,112
14,103	15,479	16,581	17,648	18,746	19,945	21,321	23,317
12,447	14,002	15,849	17,137	18,301	19,735	21,360	23,723
16,046	17,787	19,159	20,351	22,038	23,385	25,026	27,301
				22,324	24,403	26,581	29,089
26,313							
19,975							
17,830							
13,490							
12,448							

enterprise operations, e.g., director of food services, student housing, student union, athletics, and bookstore manager.

Source: 1960-72 data, National Education Association, Research Division (Copyright 1970 and 1972 by the NEA. All rights reserved.) 1972-82 data, College and University Personnel Association, *Administrative Compensation Survey*, Washington, D.C.

Table III-8

Indexes of wages and salaries of nonprofessional personnel used for the Higher Education Price Index and the Research and Development Price Index, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in tables III-4 and IV-5.)**

Fiscal year	Technicians				
	Engineering	Draftsmen	Total[1] (2.1)	Craftsmen (2.2)	Clerical (2.3)
1961	83.5 est.	85.8	82.2	83.2	83.1
1962	86.0	88.5	84.4	85.8	85.8
1963	88.5	91.7	86.7	88.1	88.0
1964	91.7	94.1 est.	89.4	90.5	90.4
1965	93.8	95.2	92.2	92.7	92.6
1966	96.4	96.6	95.6	96.1	96.4
1967	100.0	100.0	100.0	100.0	100.0
1968	105.1	105.3	105.3	105.5	105.3
1969	111.2	111.4	111.7	112.4	111.1
1970	118.2	116.9	118.7	119.0	118.0
1971	125.9	123.4	125.5	127.9	125.7
1972	132.3	132.3	132.7	137.9	133.4
1973	138.5	140.5	140.0	146.6	140.6
1974	146.8	149.9	148.2	157.9	149.6
1975	160.0	161.9	159.6 est.	172.1	164.0 est.
1976	173.0	173.9	172.0 est.	186.2	176.0 est.
1977	185.5	184.3	182.3	200.5[4]	187.6[4]
1978	198.7	197.4	195.4	216.3	201.7
1979	213.8	212.4	211.4	234.7	216.6
1980	237.3	237.5	233.6	253.9	237.4
1981	261.5	263.4	258.1	278.3	259.2
1982	286.1	285.5	279.4	302.2	281.2

[1]Technicians total index based on weighted average as follows: engineering technicians, 50 percent; draftsmen, 25 percent; and electronic data processing personnel (see table III-10 for price series), 25 percent.

[2]HEPI nonprofessional wages and salaries total index based on weighted average as follows: technicians, 10.0 percent; craftsmen, 6.7 percent; clerical, 36.0 percent; students, 13.3 percent; service, 26.7 percent; and operators and laborers, 7.3 percent.

[3]R&DPI nonprofessional wages and salaries total index based on weighted average as follows: technicians, 48.9 percent; craftsmen, 16.8 percent; clerical, 16.8 percent; and students, 17.5 percent.

[4]Beginning in 1977, salaries provided from U.S. Department of Labor Employment Cost Index (ECI) data.

Students (2.4)	Service (2.5) (HEPI only)	Operators and laborers (2.6) (HEPI only)	Nonprofessional wages and salaries total (2.0)	
			HEPI[2]	R&DPI[3]
82.3	91.9 est.	82.3	86.2	82.5
84.9	93.5 est.	84.9	87.5	85.0
87.7	95.0	87.7	89.7	87.3
90.4	96.3 est.	90.4	91.9	89.9
93.0	97.6 est.	93.0	94.0	92.5
95.9	98.9 est.	95.9	96.5	95.7
100.0	100.0	100.0	100.0	100.0
105.4	104.7 est.	105.4	105.2	105.4
111.8	109.3	111.8	110.9	111.7
118.6	116.0	118.6	117.7	118.6
128.1	128.0	128.1	126.9	126.4
138.5	138.7	138.5	136.1	134.7
147.2	148.0	147.2	144.3	142.5
157.7	156.0	157.7	153.4	151.7
171.9	164.0	171.9	165.7	164.6
186.0	178.7	186.0	179.1	177.5
199.8[4]	191.7[4]	199.8[4]	191.5	189.3
214.6	208.4	214.6	206.5	203.3
231.6	225.7	231.6	222.8	219.7
255.0	242.9	255.5	243.2	241.4
277.4	265.5	278.8	265.9	265.1
296.3	285.7	299.2	287.0	286.5

2.3 Clerical

The clerical category is priced by a fixed weight composite index of wage trends for eight clerical and clerical supervisory occupations (accounting clerks, file clerks, keypunch operators, keypunch supervisors, messengers, secretaries, stengographers, and typists) collected by the Bureau of Labor Statistics and reported in the *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC). Beginning in 1977, the BLS Employment Cost Index for clerical workers is used.

2.4 Students

The wages paid undergraduate students performing duties at a semiskilled or unskilled level are likely to be at or near minimum wage levels. However, the periodic and somewhat arbitrary setting of minimum wages under the Fair Labor Standards Act[7] results in a wage series that is disrupted, increasing in abrupt increments with long intervals of fixed values. This pattern is inconsistent with the relatively steady growth trend of wages in most occupations. Furthermore, the situation is complicated by the fact that, in 1967, institutions of higher education came under the Fair Labor Standards Act for the first time.[8] Beginning at $1 per hour, 40 cents less than the existing minimum wage stipulated for employees engaged in interstate commerce, the minimum wage rate for colleges "caught up" by rapid increases during the next 4 years. Probably few students were paid as low as $1 an hour in 1967, so this rapid increase did not report the slower growth in wages actually paid. Adding to this complexity are the minimum wage laws in many states, which variously affect student wages and which cannot easily be taken into account at the national level. These conditions preclude minimum wage rates from serving as an accurate proxy for student wages.

The proxy used for student wages is a fixed weight composite of wage trends for five unskilled plant occupations (janitors, porters, cleaners, laborers, and material handlers) collected by the Bureau of Labor Statistics and reported in the *Area Wage Survey*. To the extent that colleges and universities compete with local business firms for student employees, this wage series is a suitable and, in the absence of actual student wage data, necessary proxy. Beginning in 1977, the BLS Employ-

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[7]Minimum wage rates for employees engaged in interstate commerce set by the Fair Labor Standards Act are as follows: Jan. 1, 1960, $1/hr.; Sept. 1, 1961, $1.15/hr.; Aug. 1, 1963, $1.25/hr.; Feb. 1, 1967, $1.40/hr.; Feb. 1, 1968, $1.60/hr.; May 1, 1974, $2/hr.; and on Jan. 1 for the following years—1975, $2.10/hr.; 1976, $2.30/hr.; 1978, $2.65/hr.; 1979, $2.90/hr.; 1980, $3.10/hr.; and 1981, $3.35/hr. Source: U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division.

[8]See U.S. Department of Labor, Employment Standards Administration, Wage and Hour Division, *Institutions of Higher Education Under the Fair Labor Standards Act*, U.S. Government Printing Office, Washington, D.C., April 1973, 13 pp.

ment Cost Index for nonfarm laborers is used as a proxy for student wages.

2.5 Service

Service employees perform work in such areas as cleaning service (window washer, maid, janitor), food service (cook, dishwasher, waitress), health service (hospital attendant, nurse's aide, practical nurse), and personal service (locker room attendant, barber, welfare service aide, childcare worker). Also included in the service category are protective workers such as police, firemen, traffic officers, and park patrolmen.

The price series used for the service category is median weekly earnings of cleaning, food, health, personal, and protective service nonprofessional full-time employees. The source of the series is Bureau of Labor Statistics data derived from the *Current Population Survey*. It should be pointed out that this price series is not fixed weight; i.e., changes in the mix of occupations within the service category do affect series values. Since 1977, salaries for service personnel are from the U.S. Department of Labor Employment Cost Index (ECI) data.

2.6 Operators and laborers

This occupational group includes workers performing a variety of duties at a semiskilled and unskilled level. Examples of positions in this category are chauffeur, truckdriver, janitor, cleaner, material handler, caretaker, maintenance helper, and garage helper. The price series used is average weekly earnings for unskilled plant (men) workers in positions as janitor, porters, cleaners, laborers, and material handlers. The source of this fixed weight price series is the Bureau of Labor Statistics, *Area Wage Survey* and Employment Cost Index.

3.0 Fringe benefits

The fringe benefit category consists of expenditures by institutions for various services to staff members. The principal benefits and their usual order of importance are: retirement contributions, social security, health insurance, life insurance, unemployment compensation, worker's compensation, and income continuation insurance. Remissions of tuition and fees granted because of faculty or other staff status are usually also considered a fringe benefit.

The price series used for fringe benefits is a composite index of the difference between AAUP surveyed compensation and salary paid each academic rank. In the absence of benefits data for nonprofessional employees, the benefits price series for faculty is assumed to apply to all institutional personnel. The price index series for fringe benefits is presented in table III-9.

Table III-9

Indexes and dollar amounts of faculty fringe benefits[1] by academic rank, all institutions, fiscal years 1961-1982.

1937 = 100 **(Number code in parentheses identifies category as outlined in table III-4.)**

Fiscal year	Professors		Associate professors	
	Amount	Index	Amount	Index
1961[2]	$ 746	56.3	$ 524	56.0
1962	789	59.6	567	60.6
1963	868	65.6	614	65.6
1964	962	72.7	669	71.5
1965	1,055	79.7	735	78.5
1966	1,199	90.6	847	90.5
1967	1,324	100.0	936	100.0
1968	1,466	110.7	1,043	111.4
1969	1,689	127.6	1,241	132.6
1970[2]	1,895	143.1	1,377	147.1
1971	2,084	153.9	1,538	160.9
1972	2,314	170.9	1,703	178.1
1973	2,486	183.6	1,884	197.1
1974	2,744	202.7	2,127	222.5
1975	3,006	220.0	2,329	243.6
1976	3,343	246.9	2,576	269.5
1977	3,713	274.2	2,857	298.9
1978[4]	3,860	301.5	2,970	330.0
1979	4,370	341.3	3,385	376.1
1980	5,040	393.7	3,790	421.1
	5,020		3,790	
1981[5]	5,660	443.9	4,280	475.5
1982	6,510	510.6	4,940	548.8

[1]Fringe benefits are estimated by subtracting salaries from total compensation data.

[2]Data for fiscal year 1961 through fiscal year 1970 are consistent as a set but not comparable to later years. The 1971 data are linked to the previous series in 1970 to provide an index series without distortion.

[3]Weighted average based on the proportion of total fringe benefits paid to each academic rank in 1971-72 as follows: professors, 34.8 percent; associate professors, 24.8 percent; assistant professors, 30.4 percent; and instructors, 10.0 percent.

[4]Beginning in 1978, faculty fringe benefits are based on a substantially larger sample so that the fiscal year 1978 dollar amount data are not comparable to earlier years. However, the fiscal year 1978 indexes are based on a constant sample of institutions reporting comparable data for both fiscal year 1977 and fiscal year 1978 and therefore continue the index series without distortion.

Assistant professors		Instructors		Faculty total index (3.0)	Fiscal year
Amount	Index	Amount	Index		
$ 395	51.5	$ 284	51.9	54.9	1961
448	58.4	328	60.0	59.6	1962
487	63.5	345	63.1	64.9	1963
515	67.1	370	67.6	70.8	1964
578	75.4	407	74.4	78.1	1965
685	89.3	487	89.0	90.2	1966
767	100.0	547	100.0	100.0	1967
855	111.5	612	111.9	111.1	1968
1,053	137.3	759	138.8	131.7	1969
1,139	148.5	868	158.7	146.2	1970
1,300	166.2	1,002	179.9	162.0[3]	1971
1,440	184.1	1,149	206.3	180.2	1972
1,601	204.7	1,263	226.8	197.7	1973
1,811	231.6	1,441	258.7	222.0	1974
1,957	250.3	1,519	272.7	241.0	1975
2,151	275.1	1,690	303.4	266.7	1976
2,367	302.7	1,862	334.3	295.0	1977
2,430	332.8	1,980	363.6	324.3	1978
2,740	375.3	2,225	408.6	367.1	1979
3,030	415.0	2,270	416.9	409.4	1980
3,030		2,280			
3,390	464.3	2,550	466.3	460.2	1981
3,870	530.0	2,920	534.0	528.3	1982

[5]Beginning in 1981, fringe benefits are for *all* reporting institutions rather than the slightly smaller universe of institutions reporting comparable data in succeeding years. The 1981 data are linked to the previous series in 1980.

Source: American Association of University Professors, *Annual Report of the Economic Status of the Profession*.

In the context of a price index, fringe benefits are regarded as a package preinvestment of earnings, which, together with salary, constitute the total across-the-board compensation institutions must pay to attract and hold competent staff. Thus, the price series for fringe benefits does not price a fixed package of benefits whose form and quality are kept constant.[9] Rather the price series represents, as it does for salaries, the amount institutions are required to pay faculty and staff in this form to remain competitive in the labor market.

There is some concern that the price series for fringe benefits is inflated due to the early nonreporting by some institutions of retirement contributions not vested in the faculty member within 5 years. An institution must meet this requirement for inclusion of its retirement payments in the AAUP survey. However, a comparison of the early trend in fringe benefits for all institutions with that of 41 institutions (all of which had a vested 5-year retirement program except one), suggests that any possible upward bias is likely to be small.

CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT

Services, supplies, and equipment constituted 18.0 percent of the educational and general expenditures (excluding sponsored research) of colleges and universities during the base period 1971-72.[10] The division of these expenditures, shown in table III-4, is services, 7.3 percent; supplies and material, 3.5 percent; equipment, 2.5 percent; books and periodicals, 1.7 percent; and utilities, 3.0 percent.

These services, materials, supplies, equipment, etc., are produced and sold by a range of industries. Some purchases are relatively commonplace items typical of the operation of many organizations and commercial business; these would include office supplies and equipment, postage, telephone, utilities, and transportation. Other purchases are more specialized items necessary for instruction and research, such as scientific instruments and measuring devices, electronic data processing, chemicals, laboratory glassware, and books and periodicals. Because of the number, diversity, and specialty of these items, any grouping of

[9]It may be impossible to define a fixed package of fringe benefits. The principal difficulty is in defining a future *fixed* standard of living and estimating its *future* cost to be partially met by a retirement income established through a uniform series of yearly contributions. Any change required in the estimated future retirement income would result in higher or lower yearly contributions—a price change. While these difficulties may not be insurmountable, this approach is more theoretical than realistic. Retirement contributions by institutions are not set to provide a fixed standard of living. Rather, they are set so that, in combination with salary, the total compensation offered is competitive in the labor market. It should be pointed out that individuals, as opposed to institutions, are naturally interested in their standard of living on retirement, which accounts for the choice by some faculty to make additional TIAA-CREF payments.

[10]For fiscal years 1961 through 1967, services, supplies, and equipment were weighted 26 percent based on their budget proportion for the 1964-65 base period.

similar commodities for pricing purposes will necessarily be crude, involving approximate weightings and representative pricing.

4.0 Services

The price indexes for contracted services are presented in table III-10.

4.1 Data processing and equipment rental

In educational and general operations, the costs of data processing consist of expenditures for outside contracted services of operational and programming personnel (30 percent) and for equipment purchase and rental (70 percent). In research and development this division of costs is estimated at 60 percent and 40 percent, respectively.

Personnel services have been priced using data processing salaries reported by the periodical *Infosystems* based on its nationwide annual survey covering a variety of job classifications. In 1980 the survey reflected the salaries of electronic data processing (EDP) employees in over 1,200 installations in major metropolitan areas. A fixed weight composite average weekly salary was calculated for 20 EDP job classifications consistently reported since 1967. The jobs include managers and supervisors, computer systems analysts, programmers, computer operators, and keypunch and tape operators. From 1960 to 1966, the nationwide annual EDP salary survey was published in the periodical *Business Automation.* For this earlier period, a composite average weekly salary was calculated for 28 EDP positions and linked to the 1967-81 salary series by drawing a smooth curve consistent with the trend line of both plots.

The pricing of data processing hardware is based on monthly rental rates of the IBM 360 model 30 computer (from 1964 through 1971) and the IBM 370, model 135 computer (from 1971 through 1980), linked in 1980 and continuing to the present with the monthly rental rates of the IBM 4341 computer. The technology and capacity of these computers has remained essentially constant during their respective price periods. However, each new computer has vastly improved technology over the older model, having greater capacity, more sophisticated processing capabilities, greater speed, lower cost per operation, and smaller physical size. By linking, the price differentials due to changes in product design are not reflected in the price index numbers for computer hardware.

It should be kept in mind that while price increases for fixed model computers have been very modest during the last decade, colleges and universities have been continually upgrading their data processing capabilities by purchasing newer, more expensive computers of advanced design. Thus, total expenditures for data processing and computers has increased greatly, almost all being "real" growth in constant dollars with little erosion of purchasing power because of price increases. And from a

Table III-10

Indexes of contracted services used for the Higher Education Price Index and the Research and Development Price Index, fiscal years 1961-1982.

1967 = 100 (Number code in parentheses identifies category as outlined in table III-4.)

Fiscal year	Data processing and equipment rental: EDP personnel salaries	EDP hardware	Total[1] HEPI (4.1)	Total[1] R&DPI (4.1)	Communication (4.2)	Transportation (4.3)
1961	76	95.7 est.	89.8	83.9	98.1	84.1
1962	77	96.4 est.	90.6	84.8	98.2	87.6
1963	78	97.1 est.	91.4	85.6	99.5	89.1
1964	80	97.4 est.	92.2	87.0	101.1	90.7
1965	86	98.5	94.8	91.0	100.6	92.5
1966	93	98.5	96.9	95.2	98.4	93.7
1967	100.0	100.0	100.0	100.0	100.0	100.0
1968	105.8	101.6	102.9	104.1	101.1	104.0
1969	113.0	101.6	105.0	108.4	103.5	110.3
1970	121.4	99.3	105.9	112.6	104.4	121.7
1971	126.8	98.5	107.0	115.5	108.1	135.6
1972	133.8	101.9	111.5	121.0	117.4	143.2
1973	142.6	105.2	116.4	127.6	120.8	146.3
1974	149.4	106.0	119.0	132.0	126.1	148.2
1975	156.4	110.4	124.2	138.0	132.2	153.3
1976	168.0	115.8	131.5	147.1	140.5	170.8
1977	173.9	118.0	134.8	151.5	148.0	181.2
1978	186.8	118.0	138.6	159.3	149.9	188.5
1979	206.6	118.0	144.3	170.6	155.3	193.8
1980	222.3	123.9	153.4	182.9	156.8	224.8
1981	245.8	147.5	177.0	206.5	164.1	286.0
1982	259.7	165.4	193.7	222.0	187.4	339.4

[1]Data processing and equipment rental total index based on weighted average as follows: HEPI – EDP personnel salaries, 30 percent; EDP hardware, 70 percent. R&DPI – EDP personnel salaries, 60 percent; EDP hardware, 40 percent.

[2]HEPI services index total based on weighted average as follows: data processing and equipment rental, 19.2 percent; communication, 20.55 percent; transportation, 9.6 percent; printing and duplication, 0.85 percent; and miscellaneous services, 43.8 percent.

[3]R&DPI services index total based on weighted average as follows: data processing and equipment rental, 18.1 percent; communication, 5.0 percent; transportation, 12.5 percent; printing and duplication, 5.0 percent; miscellaneous services, 52.5 percent; and consultants and other professional services, 6.9 percent.

Printing and duplication (4.4)	Miscella-neous services (4.5)	Consultants and other professional services (4.6) (R&DPI only)	Services total HEPI[2] (4.0)	Services total R&DPI[3] (4.0)	Fiscal year
85.6	81.3	70.5	86.9	82.4	 1961
87.7	83.7	73.9	88.7	84.6	 1962
89.4	86.5	77.7	90.6	86.8	 1963
91.3	89.4	83.7	92.6	89.3	 1964
93.7	92.7	88.5	94.8	92.5	 1965
96.8	96.0	93.5	96.5	95.6	 1966
100.0	100.0	100.0	100.0	100.0	 1967
103.4	105.5	107.1	103.8	104.8	 1968
108.6	111.6	114.4	108.3	110.5	 1969
114.0	118.5	121.6	113.2	117.1	 1970
119.7	126.4	128.6	119.3	124.5	 1971
126.5	133.4	134.3	126.4	131.3	 1972
132.1	140.6	139.2	131.9	137.4	 1973
140.1	149.5	147.2	138.1	144.4	 1974
159.9	161.9	154.9	150.2	154.4	 1975
163.7	172.7	165.5	157.4	165.3	 1976
174.6	185.0	175.0	166.7	175.4	 1977
187.2	200.4	185.1	176.1	187.2	 1978
202.8	215.8	198.7	186.6	200.0	 1979
224.6	235.9	215.5	201.8	218.9	 1980
241.9	259.0	236.6	225.2	245.7	 1981
264.1	283.6	260.5	250.6	272.0	 1982

benefit-cost ratio standpoint, recent advances in computer technology are reported to have doubled processing capability at half the cost—a fourfold improvement in return per-dollar investment. Again, this improvement in utility does not in any way alter price index values for computer hardware, which report only price changes for products of constant quality.

4.2 Communication

This subindex is a fixed weight average of the Bureau of Labor Statistics CPI series for residential telephone service (82 percent) and postal charges (18 percent).

4.3 Transportation

This subindex is the CPI price series for public transportation, which represents fares for local transit, taxicab, railroad (coach), airplane (chiefly coach), and intercity bus. Future development of the price series for this subindex should include a component reflecting the considerable use of automobile transportation (leasing, rentals, reimbursement for private use, etc.) by college personnel.

4.4 Printing and duplication

The primary expenditures made by colleges and universities in printing and duplication are for production. Associated overhead expenditures for administration, services, utilities, etc., are small and generally included in their own categories. In a 1973 survey, the Printing Industry of America determined that the major direct costs of production—paper and worker payroll—were in the ratio of 2 to 3. Using this ratio, a fixed weight composite index is used for printing and duplication based on the Bureau of Labor Statistics Producer Price Index price series for book paper #2 plain offset (BLS No. 0913-0122), weighted 40 percent, and the average weekly earnings of production or nonsupervisory workers in the printing and publishing industry, weighted 60 percent, collected by the Bureau of Labor Statistics as part of its Employment and Earnings series.

4.5 Miscellaneous services

This category includes contracts for a variety of professional, technical, and skilled services provided by consultants, technicians, and craftsmen hired by colleges and universities from outside the institution for particular jobs or projects. (Payment of legal fees is an example.) Also included as miscellaneous services are expenditures for such items as insurance, advertising, dues and memberships, contributions and prizes, taxes, laundry, and trucking.

The proxy for pricing this broad service category is a composite index of salaries for professional, administrative, and technical support col-

lected by the Bureau of Labor Statistics for its *National Survey of Professional, Administrative, Technical, and Clerical Pay* (PATC). Occupations in this group are accountants, auditors, chief accountants, attorneys, buyers, job analysts, directors of personnel, chemists, engineers, engineering technicians, and draftsmen. Each of the 11 occupations are given equal fixed weight in the composite index.

5.0 Supplies and materials

The extensive number, specialization, and variety of supplies and materials used by colleges and universities, plus the lack of related detailed accounting data, permit use of only broad category items and approximate weightings. In particular, the near complete absence of R&D supply and material data and applicable price series reduces the precision of the R&D supplies and materials subindex to a gross and limited estimate. The HEPI supplies and materials subindex series is presented in table III-1.

Major supply and material categories, separate estimates of their relative weights for educational and general expenditures and for sponsored research, and Producer Price Index (PPI) commodity price series used for the supplies and materials subindex are shown below. Because many of the bulk products purchased by colleges and universities involve transactions in primary rather than retail markets, considerable use is made of PPI product class price series in this expenditure category as well as for equipment and utilities.

Supply and material category	PPI commodity price series	Estimated relative weight[1] HEPI	R&DPI
Chemical and glass supplies	Industrial chemicals, BLS No. 061 Glass containers, BLS No. 138	6	10
Electronic technical supplies	Electronic components and accessories, BLS No. 1178	5	6
Photographic supplies	Photographic supplies, BLS No. 1542	3	4
Drugs and pharmaceuticals[2]	Drug and pharmaceutical materials, BLS No. 0631	2	4
Stationery and office supplies	Office supplies and accessories, BLS No. 0915-06 Writing paper, rag content, BLS No. 0913-0141 Pens and pencils, BLS No. 1595	40	20
Forage and animal supplies[2]	Grains, BLS No. 0122	3	4

Supply and material category	PPI commodity price series	Estimated relative weight[1] HEPI	R&DPI
Gasoline, oil, and lubricants	Gasoline, BLS No. 0571 Finished lubricants, BLS No. 0576	4	2
Operation and maintenance supplies	Soaps and synthetic detergent, BLS No. 0671 Electric lamps/bulbs, BLS No. 1177 Prepared paints, BLS No. 0621 Mixed fertilizers, BLS No. 0651 Sanitary papers and health products, BLS No. 0915-01 Brushes, BLS No. 1597	12	...
Materials and supplies-general	Intermediate materials, supplies and components, excluding intermediate materials for food manufacturing and manufactured animal feeds	25	50
		100	100

[1]Weight estimates based on limited data provided by the General Financial Reporting Office, the University of Wisconsin System, Madison. Within supply and material categories the various PPI commodity price series used are assigned PPI weights.

[2]The R&DPI prices research performed at universities, excluding the research activities of associated medical schools and agricultural stations. The weights assigned to drugs and pharmaceuticals and to forage and animal supplies have been reduced accordingly.

6.0 Equipment

Accounting practices for classifying equipment purchases vary among institutions, with no standard definitions commonly applied. However, the type of equipment generally purchased as part of current operations is usually small and easily movable. To be classified as "equipment" rather than as "expendable utensils" or "supplies," an item generally must cost $50 or more and have a useful life of at least 3 years. Examples are projectors, calculators, slide rules, microscopes, fans, cameras, tape recorders, and typewriters. Larger, more expensive, permanent equipment is generally purchased with plant funds. Note also that standard accounting practice generally includes equipment repair within current fund expenditures for equipment.

Detailed breakdown of current fund expenditures for equipment by type of equipment purchased is not available. Thus, a few equipment items included in the Producer Price Index series have been selected as *representative* of the many small types of equipment purchased by colleges and universities. As a result, the surrogate subindex for equipment,

as for supplies and materials, is a limited estimate. The HEPI equipment subindex series is present in table III-1.

Major equipment categories, separate estimates of their relative weights for educational and general expenditures and for sponsored research, and Producer Price Index commodity price series used for the equipment subindex are shown below.

Equipment category	PPI commodity price series	Relative weight[1] HEPI	R&DPI
Rental	Machinery and equipment, BLS No. 11	15	5
Repair	Craftsmen average weekly earnings, BLS *Area Wage Surveys*	20	10
Office	Office and store machines and equipment, BLS No. 1193	15	5
Machinery, tools, and apparatus[2]	Hand tools, BLS No. 1042 Cutting tools and accessories, BLS No. 1135 Electrical machinery and equipment, BLS No. 117 Welding machines and equipment, BLS No. 1133 Fabricated structural metal products, BLS No. 107	40	70
Classroom and laboratory[2]	Scales and balances, BLS No. 1146 Electrical integrating and measuring instruments, BLS No. 1172 Television receivers, BLS No. 1252 Musical instruments, BLS No. 1593 Photographic equipment, BLS No. 1541 Sporting and athletic goods, BLS No. 1512	10	5
Books	Price series for hardcover trade and technical books, *The Bowker Annual of Library and Book Trade Information*	...	5
		100	100

[1]Weight estimates based on limited data provided by the Central Financial Reporting Office, the University of Wisconsin System, Madison.

[2]Within equipment categories, the various PPI commodity price series used are weighted equally as representative items.

7.3 *Books and periodicals*

This subindex, presented in table III-11, is a fixed weight average of the price series for selected hardcover trade and technical books (pub-

Table III-11

Average prices and indexes for U.S. hardcover books and periodicals and for foreign monographs, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in table III-4.)**

Year		U.S. hardcover books		U.S. periodicals	
Calendar	Fiscal	Average price CY	Index[3] FY	Average price CY	Index[3] FY
1960	1961	$ 5.24	66.0	$ 5.32	71.5
1961	1962	5.81	73.2	5.63	75.7
1962	1963	5.90	74.3	5.92	79.6
1963	1964	6.55	82.5	6.31	84.8
1964	1965	6.93	87.3	6.64	89.2
1965	1966	7.65	96.3	6.95	93.4
1966	1967	7.94	100.0	7.44	100.0
1967	1968	7.99	100.6	8.02	107.8
1968	1969	8.47	106.7	8.65	116.3
1969	1970	9.44	118.9	9.31	125.1
1970	1971	11.66	146.9	10.41	139.9
1971	1972	13.25	166.9	11.66	156.7
1972	1973	12.99[5]	173.3[5]	13.23	177.8
1973	1974	12.20[5]	179.8[5]	16.20	217.7
1974	1975	14.09	207.6	34.55[6]	238.0
1975	1976	16.19	238.6	38.94	268.2
1976	1977	17.20[7]	253.5	41.85	288.2
1977	1978	18.03	265.7	45.14	310.9
1978	1979	20.10	296.2	50.11	345.2
1979	1980	22.80	336.0	57.23	394.2
1980	1981	23.57	347.3	67.81	457.1
1981	1982	25.48	375.4	73.89	509.0

[1]All hardcover books, paperbacks, and pamphlets purchased during the fiscal year by the Library of Congress from approximately 100 foreign countries.

[2]Weighted average based on the estimated proportion of the total acquisition budget expended for each category. Weights used – U.S. hardcover books, 55 percent; U.S. periodicals, 30 percent; and foreign monographs, 15 percent.

[3]Indexes are not fixed-weight indexes; they reflect changes in the type and mix of books and periodicals from year-to-year. The fiscal year index refers to average price in the previous calendar year due to the normal time delay between published date and purchase.

[4]The total book and periodical index value of 163.8 was assigned to foreign monographs to introduce this price series without effect in FY 1972. The foreign monographs indexes as a result have no relevance to 1967 = 100.

[5]In 1972 and 1973, *Publishers Weekly* converted from pricing hardcover books per title (a set of books under one title priced as a single entry) to pricing per volume. The discontinuity created by this change has been avoided by adjusting 1972 prices upward (× 1.059) and linking the 1973-75 price series (× 1.17) to an estimated long-term price trend of hardcover books based on information provided by book wholesalers.

Foreign monographs[1]		Total book and periodical index[2]
Average price CY	Index[3] FY	FY (7.0)
		67.7
		74.0
		75.9
		83.2
		87.9
		95.4
		100.0
		102.8
		109.6
		120.8
		144.8
$ 4.65	163.8[4]	163.8
5.37	189.2	177.0
5.89	207.5	195.3
6.42	226.1	219.5
7.59	267.4	251.8
7.91	278.6	267.7
8.89	313.2	286.4
9.41	331.5	316.2
11.52	405.8	363.9
13.05	459.7	400.1
13.84	487.5	432.3

[6]Beginning in 1974 and linked to the previous Brown price series, U.S. periodicals are priced on a 1-year subscription basis by the F.W. Faxon Co. based on 29 Authority Groups weighted according to the number of libraries among Faxon's clients that subscribe to each title in each group.

[7]In 1976, *Publishers Weekly* reported a book price of $17.39 for an 18-month period 1976-77. An adjusted value of $17.20 for calendar year 1976 was determined from the trend line.

Source: Prices of hardcover books are based on books listed in the "Weekly Record" section of *Publishers Weekly* for the calendar year with an imprint for the same year. Not included are mass-market paperbacks, Government documents, and certain multivolume encyclopedias. Published in *The Bowker Annual of Library and Book Trade Information*, R.R. Bowker, New York. U.S. periodical prices for 1970-74 are prepared by Norman B. Brown based on a total group of 3,151 titles published in the July issues of the *Library Journal*. Since 1974, U.S. periodicals are priced by the F.W. Faxon Co. and reported by F.F. Clasquin in the October issues of *Library Journal*. Foreign monographs are priced according to an unpublished price series prepared by the Library of Congress.

Table III-12

Indexes of utilities used for the Higher Education Price Index, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in table III-4.)**

Fiscal year	Natural gas (8.1)	Commercial power (8.2)	Residual fuels (heating oil) (8.3)	Water and sewerage (8.4)	Utilities total HEPI[1] (8.0)
1961	94.3	103.2	109.4	86.8	100.3
1962	97.1	103.2	107.6	88.0	100.9
1963	97.7	102.6	105.0	90.9	100.7
1964	98.7	101.5	101.3	93.0	100.1
1965	98.3	100.9	101.4	94.6	99.8
1966	99.2	100.2	102.0	97.6	99.9
1967	100.0	100.0	100.0	100.0	100.0
1968	101.8	100.9	92.2	104.2	100.5
1969	102.9	101.7	89.9	109.7	101.6
1970	105.3	102.5	94.7	116.2	103.7
1971	109.6	107.8	150.3	130.1	114.6
1972	117.0	116.2	154.3	138.5	122.4
1973	126.4	122.4	158.1	144.3	129.0
1974	142.5	137.0	323.6	152.3	158.3
1975	183.6	167.6	491.5	164.4	202.9
1976	242.5	181.3	437.2	181.3	219.1
1977	364.3	196.9	470.0	200.9	258.1
1978	454.8	217.6	487.2	222.4	292.5
1979	550.4	224.8	515.6	242.7	320.8
1980	745.7	254.9	814.8	253.9	409.0
1981	971.6	295.4	1,088.4	276.2	508.0
1982	1,221.0	332.2	1,143.2	315.1	589.4

[1]Utilities total index based on weighted average as follows: natural gas, 20 percent; commercial power, 60 percent; residual fuels, 10 percent; water and sewerage, 10 percent.

lished in *The Bowker Annual of Library and Book Trade Information*) and the U.S. periodicals price series reported by F.F. Clasquin in the October issues of *Library Journal*. Foreign monographs are priced according to an unpublished price series prepared by the Library of Congress. The weights of 70 percent for hardcover books and 30 percent for periodicals are based on the expended proportions of the new acquisitions budget of colleges and universities, estimated from fall 1973 library data collected but not tabulated by the U.S. Office of Education.

8.0 Utilities

This subindex is a composite of the Producer Price Index series for natural gas (BLS No. 0531-0101), residual fuels (BLS No. 0574), commercial electrical power (BLS No. 0542), and water and sewerage services (CPI). The weights—heating fuel, 30 percent (natural gas, 20 percent; residual fuels, 10 percent); commercial power, 60 percent; and water and sewerage services, 10 percent—are based on University of Wisconsin System data modified for a central U.S. latitude. The utilities subindex series is presented in table III-12.

IV. UNIVERSITY RESEARCH AND DEVELOPMENT PRICES AND INDEXES

Sponsored research and development at institutions of higher education, which is performed primarily by universities and sponsored by Federal agencies, was funded at $5.2 billion in fiscal year 1980. Adding to this some $1.2 billion for associated federally funded R&D centers brings total R&D expenditures at colleges and universities to approximately 13 percent of all research and development sponsored in the United States.[1]

As with any large aggregate, it is difficult to gain meaning from dollar amounts of this magnitude. To do this, it is necessary to relate absolute values to a relevant base, in this instance by dividing by the number of university research scientists and engineers. In unit terms—R&D expenditures per scientist—total dollars are scaled down to a meaningful user unit level. Further insight can be gained by comparing unit expenditures over time to identify relative growth or decline. This operation, to be realistic, must compare dollars of constant purchasing power. In times of rapid inflation, comparison of actual (current) dollars from year-to-year can be extremely misleading, and, at best, a relatively meaningless exercise.

The Research and Development Price Index (R&DPI) presented in this chapter is designed to remove the effects of inflation from college and university research expenditures by converting actual to constant (deflated) dollars. The index is described beginning on page 92. The discussion immediately below shows how the index can be used to analyze the effects of inflation on R&D expenditures.

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[1]Industry, supported by its own and by Federal funds, performed 70 percent of all basic research, applied research, and development. The share performed by other sectors was as follows: Federal Government, 13 percent; colleges and universities, 10 percent; federally funded R&D centers associated with universities and colleges, 3 percent; and other nonprofit institutions, 4 percent. U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the United States: 1980*, U.S. Government Printing Office, Washington, D.C., p. 624.

The Effects of Inflation on Research and Development

Price Trends

Much of the discussion of price trends affecting the current operations of colleges and universities applies, with slight quantitative differences, to research and development. During the 20-year period 1961-81, the prices of goods and services purchased for research and development increased 3.2 times. This trend parallels the price changes in current operations as measured by the HEPI. And as is also the case for current operations, R&D costs since 1973-74 have risen slower than the inflation affecting the general economy because the largest purchase is faculty and other professional research services, the salaries for which have not kept pace with the price of durable commodities. Price trends within the Research and Development Price Index are shown in table IV-4. Although there are slight quantitative differences between the price series for each of the R&DPI subindexes and their counterparts in the HEPI, the presentation of price trends within the HEPI is relevant to the subindexes of the R&DPI. The reader is therefore referred to the previous chapter for a discussion of the price trends of each of the R&DPI subindexes (professional salaries; nonprofessional wages and salaries; fringe benefits; services, supplies, and materials; and equipment).

Deflation of Expenditures

Placing absolute amounts on an appropriate base dimension provides perspective on available resources. Just as educational and general expenditures are reported per student, research and development expenditures can also be related to users, in this case college and university scientists and engineers engaged in research. This unit measure reports the *financial resources available per research participant.*

The source for research personnel data is the National Science Foundation's (NSF) *Survey of Scientific and Engineering Personnel Employed at Universities and Colleges.* This survey reports the number of full-time equivalent scientists and engineers engaged in research and development at doctorate-granting institutions, including faculty members, postdoctorals, and other professionals working in the sciences and engineering and in research administration at the departmental level. The fields covered include the physical, environmental, mathematical, life, and social sciences, psychology, and engineering. Researchers in the arts, the humanities, and law are excluded. Research personnel at medical schools are included, but research personnel at federally funded

research and development centers are not. The NSF data are presented in table IV-1.

The consequences of changes in the numbers of research staff and in prices on R&D expenditures by colleges and universities are shown in table IV-2 and figures IV-1 and IV-2 and are summarized in table IV-3. In the early sixties, sponsored research funding was evenly divided between the public and private sectors. Gradually, but steadily, the public sector gained ground, and in 1981, the split was roughly 64 percent public and 36 percent private. This change has been accompanied by a near-parallel shifting in the distribution of R&D scientists and engineers. As a result, both sectors have experienced similar growth rates in R&D expenditures per scientist and engineer; that is, public universities have spread large increases in research funding over equally large increases in scientists, whereas private universities have had smaller increases in both funding and research personnel.

When inflation is taken into account, the public sector has experienced a slight increase in constant R&D dollars per scientist and engineer; in the private sector, there has been no gain. In both instances, this near-level purchasing power should be interpreted as a relative loss in research funding since the R&DPI adjustment for inflation assumes a fixed

Table IV-1

Full-time-equivalent scientists and engineers employed in research and development at doctorate-granting institutions, fiscal years 1973-1981.

Fiscal year	Total FTE R&D scientists and engineers[1]	Public institutions	Private institutions
1973	45,293	26,432	18,861
1974	46,396	28,051	18,345
1975	49,542	30,211	19,331
1976	51,574	31,508	20,066
1977	52,785	33,206	19,579
1978	53,317	33,038	20,279
1979	54,432	32,919	21,513
1980	55,433	33,803	21,630
1981	55,325	33,967	21,358

[1]Full-time-equivalent scientists and engineers engaged in separately budgeted research and development include faculty members, postdoctorals, and other professionals working in the sciences (physical, environmental, mathematical, life, and social sciences, and psychology) and engineering and in research administration at the department level and associated medical schools. Federally funded research and development center personnel are excluded.

Source: National Science Foundation, *Survey of Scientific and Engineering Personnel Employed at Universities and Colleges*, January 1982.

Table IV-2

Expenditures for sponsored research and development in public and private universities, amount and amount per FTE scientist and engineer in actual and constant dollars, fiscal years 1973-1981.

Fiscal year	All universities				Public universities			
	Amount (in millions)		Per FTE scientist and engineer[1]		Amount (in millions)		Per FTE scientist and engineer[1]	
	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]	Actual dollars	Constant dollars[2]
1973	1,773	1,773	39,145	39,145	1,048	1,048	39,649	39,649
1974	1,924	1,807	41,469	38,951	1,205	1,132	42,957	40,348
1975	2,370	2,036	47,838	41,105	1,475	1,267	48,823	41,952
1976	2,491	1,997	48,300	38,729	1,566	1,256	49,702	39,853
1977	2,717	2,051	51,473	38,856	1,728	1,304	52,039	39,283
1978	2,961	2,100	55,536	39,382	1,897	1,345	57,419	40,717
1979	3,312	2,179	60,847	40,028	2,136	1,405	64,887	42,686
1980	3,758	2,268	67,794	40,906	2,420	1,460	71,591	43,197
1981[3]	4,219	2,316	76,258	41,858	2,702	1,483	79,548	43,664

[1]Full-time equivalent scientists and engineers engaged in research and development include faculty members, postdoctorals, and other professionals working in the sciences (physical, environmental, mathematical, life, and social sciences, and psychology) and engineering and in research administration at the departmental level and associated medical schools. Federally funded research and development center personnel are excluded.

[2]Constant dollars in 1972 prices.

market basket of goods and services with no adjustment for the added costs of improved research equipment. For example, no allowance is made for new and more expensive computers of greater capacity and speed, yet a constant requirement for such upgrading exists in modern research. Thus, level research funding in constant purchasing power dollars actually reflects a decline in ability to support research with current technology.

Why are public institutions receiving an increasing share of R&D funding, a share that is disproportionate to the relative numbers of scientists and engineers involved? A few factors bear on the situation, but none provides a conclusive answer. Using university full-time faculty as an approximate indicator of the *potential* staff to perform research, the

Private universities					
Amount (in millions)			Per FTE scientist and engineer[1]		Fiscal year
Actual dollars	Constant dollars[2]		Actual dollars	Constant dollars[2]	
725	725		38,439	38,439	1973
719	675		39,193	36,813	1974
895	769		46,299	39,783	1975
925	742		46,098	36,963	1976
989	747		50,513	38,131	1977
1,064	755		52,468	37,206	1978
1,176	774		54,665	35,961	1979
1,338	807		61,859	37,324	1980
1,517	833		71,027	38,986	1981

[3]Numbers estimated.

Note: Amounts do not include recovery of indirect costs. Also excluded are research expenditures in federally funded research and development centers administered by universities and consortia.

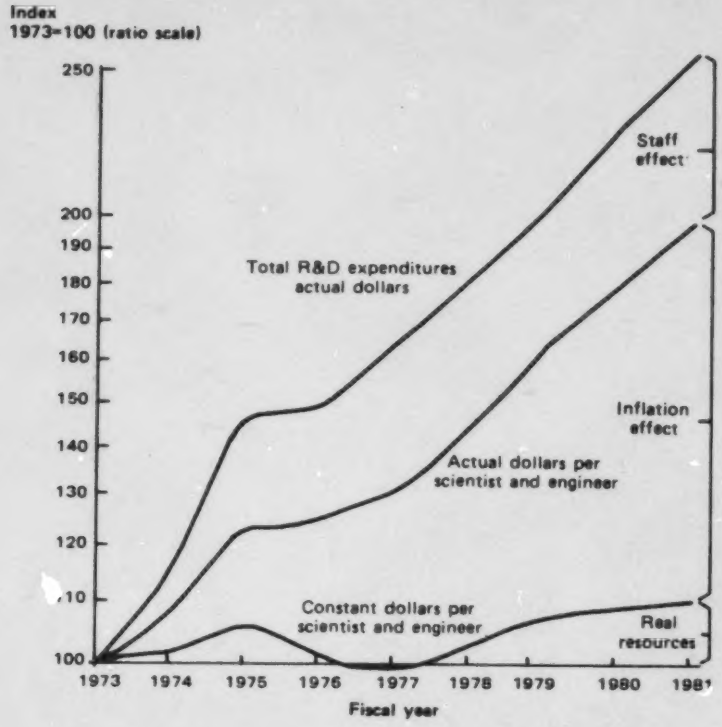
Source: U.S. Department of Education, National Center for Education Statistics, *Financial Statistics of Institutions of Higher Education: Current Funds Revenues and Expenditures.*

amount of R&D funding per potential researcher is substantially higher in the private sector than in the public ($29,836 compared with $45,975 in 1981).

The number of people engaged in sponsored research at any institution depends, of course, on the amount of R&D funding received. More and larger grants generally involve more research personnel. It may be that with a higher level of funding per potential user, private institutions make a greater effort to engage as many faculty in sponsored research as possible. The opposite may occur at some public colleges and universities where a commitment to teaching could restrict and discourage extending faculty involvement in sponsored research. Then again, it may simply be that by having proportionately more of their research sponsored by

Figure IV-1

Trends in expenditures for sponsored research and development in public institutions, amount and amount per R&D scientist and engineer in actual and constant dollars, fiscal years 1973-1981.



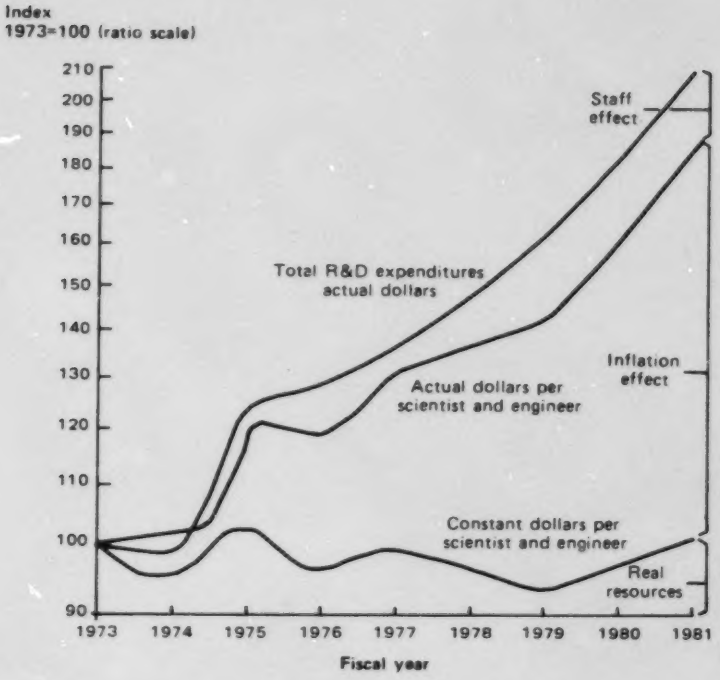
Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal distances reflect equal proportional (as distinguished from absolute) changes.

philanthropic and nongovernmental sources, private institutions obtain relatively more small private grants and fewer large Federal contracts than do public institutions.

Other, secondary factors also assist in explaining why research funding per scientist and engineer is growing at public institutions. The gradual dominance in enrollments by the public sector (75 percent of FTE students in 1981, compared to 60 percent in 1961) may have wrought a parallel ascendancy in sponsored research. In sheer numbers of applicants alone, the public sector has a competitive advantage in securing

Figure IV-2

Trends in expenditures for sponsored research and development in private institutions, amount and amount per R&D scientist and engineer in actual and constant dollars, fiscal years 1973-1981.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

research grants. Some private institutions, perhaps more sensitive to the negative attitude of students and alumni toward military research, may have intentionally declined continuation of work in this controversial area. Private colleges and universities may also be more hesitant to accept research contracts having restrictive clauses. Finally, and perhaps a more important factor, financial difficulties may have forced many private institutions to decline those research grants for which funding does not adequately cover associated indirect or overhead costs.

Table IV-3

Comparison of public and private university research and development expenditures, scientists and engineers, and university full-time faculty, fiscal years 1973-1981.

Fiscal year	Share of total R&D expenditures		Share of FTE R&D scientists and engineers		R&D expenditures per scientist and engineer	
	Public	Private	Public	Private	Public	Private
1973	59.1	40.9	58.4	41.6	$39,649	$38,438
1974	62.6	37.4	60.5	39.5	42,957	39,193
1975	62.2	37.8	61.0	39.0	48,823	46,299
1976	62.9	37.1	61.1	38.9	49,702	46,098
1977	63.6	36.4	62.9	37.1	52,039	50,513
1978	64.1	35.9	62.0	38.0	57,419	52,468
1979	64.5	35.5	60.5	39.5	64,887	54,865
1980	64.4	35.6	61.0	39.0	71,591	61,859
1981	64.0	36.0	61.4	38.6	79,548	71,027

[1]University full-time faculty includes all ranks.

Note: Data on R&D scientists and engineers and on R&D expenditures are from tables IV-1 and IV-2, respectively.

Source: U.S. Department of Education, National Center for Education Statistics.

Description of Index and Data Base

The first price index for "deflation of academic R&D expenditures" was developed by Sidney A. Jaffe and published by the National Science Foundation in 1971 and 1972.[2] The index was intended to measure the effects of price change, and price change only, on the kinds and amounts of goods and services purchased (inputs) for research and development activities by universities and colleges.

The Research and Development Price Index (R&DPI) presented here employs the same methodology and a weighting pattern similar to that used by Jaffe. However, there are substantial differences in the degree of detail, the weighting of specific items, and the various price series selected. These modifications and refinements, made possible by the

[2]See National Science Foundation, *A Price Index for Deflation of Academic R&D Expenditures* (NSF 72-310), U.S. Government Printing Office, Washington, D.C., 1972.

Full-time faculty[1] (share in parentheses)		R&D expenditures per full-time faculty		Fiscal year
Public	Private	Public	Private	
—	—	—	—	1973
—	—	—	—	1974
86,566 (73.8)	30,785 (26.2)	17,039	29,073	1975
82,014 (72.1)	31,003 (27.9)	19,094	29,836	1976
—	—	—	—	1977
—	—	—	—	1978
87,364 (74.6)	29,783 (25.4)	24,449	39,486	1979
90,152 (73.2)	32,936 (26.8)	26,844	40,624	1980
90,561 (73.3)	32,996 (26.7)	29,836	45,975	1981

availability of more recent and detailed expenditure and price data, result in a higher rate of price change for R&D compared to the Jaffe index series.[3] As with all price indexes, users should bear in mind the appropriate uses and limitations, which stem from the approach and the data utilized.

The R&DPI prices current *direct* expenditures by universities for sponsored research and development, excluding expenditures for large, expensive, scientific equipment and furnishings (generally charged as an indirect cost) and separately budgeted physical plant investment and permanent fixed equipment. The index does not price departmental research done as a part of regular instructional services and budgeted as instruction and departmental research. The index also excludes indirect costs or

[3]The compounded annual increase rate for the two series for the 1961-71 period are: Jaffe, 4.0 percent; R&DPI, 4.9 percent. This difference is due primarily to the heavier weighting given personnel compensation (67 percent versus 65 percent) and the use of an entirely different set of price series than employed by Jaffe.

overhead charges apportioned to research (e.g., expenditures for general administration, operation and maintenance of the physical plant, etc.) because of their varied and often arbitrary proportionment to research operations.[4] The index and its subcomponents are presented in table IV-4.

Direct costs of R&D activities include such expenses as wages and salaries and purchases of small or expendable equipment, supplies, and services that can be directly related and charged as current operating costs to research projects. The composition of such costs and their proportion of the research budget are presented in table IV-5. Wages and salaries (including fringe benefits) paid to university employees engaged in and supporting research make up 67 percent of direct R&D expenditures. The other major expenditure categories and their percentage weights are: services, 16.0 percent; supplies and materials, 7.0; and small movable equipment charged as direct costs, 10.0 percent.

Index Weighting Structure

The composition of university research and development expenditures of object classification used for computing the Research and Development Price Index is shown in table IV-5. As previously explained, the R&DPI is constructed in the conventional manner by applying the pattern of expenditure weights shown to price trend series. The weights are estimated proportions of research and development expenditures at universities during the 1971-72 base year. Thus, the index portrays estimated changes in prices of an R&D expenditure aggregate with a fixed composition of inputs or purchases.

The index weights in table IV-5 for personnel compensation (67.0 percent) and for the various professional and nonprofessional categories have been estimated from data derived in the National Science Foundation biennial surveys of universities and colleges covering R&D funding for academic years 1965-66 through 1972-73. Research expenditure data by object classification prepared by the University of Wisconsin System[5] were used to estimate those subcategories not reported in the NSF surveys.

Faculty are weighted by rank to correspond to R&D participation as suggested by their primary and secondary assignments in 1963.[6] Out of

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[4]National Science Foundation data suggest that indirect costs average roughly 30 percent of direct costs.

[5]Central Financial Reporting Office, *Worksheet*, "Summary of Expenditures by Major & Minor Object Class, 1972-73," The University of Wisconsin System, Madison, 1973.

[6]Ralph E. Dunham, Patricia S. Wright, and Majorie O. Chandler, *Teaching Faculty in Universities and Four-Year Colleges, Spring 1963*, U.S. Department of Health, Education, and Welfare, Office of Education, U.S. Government Printing Office, Washington, D.C., 1966, pp. 73 and 75.

approximately 125,000 teaching faculty, the 22,797 (18,616 at universities) reporting organized research as a primary or secondary assignment were composed by rank as follows: professor, 34.0 percent; associate professor, 30.1 percent; assistant professor, 29.0 percent; and instructor, 6.9 percent. Multiplying these percentages by 1971-72 university salary data results in the relative budget expenditure by rank for teaching faculty involved in research. These budget weights are: professor, 44.3 percent; associate professor, 28.8 percent; assistant professor, 22.7 percent; and instructor, 4.2 percent. The accuracy of this division is not critical since the differentials between salary trends of the various faculty ranks are small.

The weights shown in table IV-5 should be interpreted as rough estimates suggestive of general magnitudes rather than of precise dimensions. Because few institutions or state systems report research expenditures by detailed object classification and because there is little standardization in reporting procedure, the distribution of weights among the categories from a sample of institutions can only approximate true national averages. However, the price trends that are associated with many related subcategories are very similar. Therefore, the composite R&DPI would be little altered if these weights were to be distributed somewhat differently.

Index Prices and Data Sources

This section, together with relevant material from the HEPI "Index Prices and Data Sources" section, describes items priced for the R&DPI.

PERSONNEL COMPENSATION

1.0 Professional salaries

Subindexes for salaries of the various professional personnel categories are shown in IV-6.

1.1 Faculty (university)

The university faculty subindex consists of a weighted average of individual indexes of the salaries of professors, associate professors, assistant professors, and instructors as shown in table IV-7. The weights are based on the proportion of total faculty salaries paid to each academic rank in 1971-72.

Faculty play the most important role in academic research as project directors, principal investigators, and associated consultants. The salary data compiled by the American Association of University Professors

Table IV-4

Research and Development Price Index and major component subindexes, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in table IV-5.)**

Fiscal year	Personnel compensation			
	Professional salaries (1.0)	Nonprofessional wages and salaries (2.0)	Fringe benefits (3.0)	Total[1]
1961	75.0	82.5	54.9	74.5
1962	77.8	85.0	59.6	77.4
1963	81.6	87.3	64.9	81.1
1964	85.7	89.9	70.8	85.0
1965	89.9	92.5	78.1	89.2
1966	93.8	95.7	90.2	93.8
1967	100.0	100.0	100.0	100.0
1968	106.1	105.4	111.1	106.5
1969	112.8	111.7	131.7	114.5
1970	119.8	118.6	146.2	122.3
1971	125.9	126.4	162.0	129.8
1972	131.6	134.7	180.2	137.3
1973	136.1	142.5	197.7	143.9
1974	142.4	151.7	222.0	152.7
1975	150.6	164.6	241.0	163.0
1976	160.5	177.5	266.7	175.2
1977	169.1	189.3	295.0	186.6
1978	178.2	203.3	324.3	198.8
1979	189.3	219.7	367.1	214.4
1980	200.9	241.4	409.4	231.3
1981	220.1	265.1	460.2	254.8
1982	236.9	286.5	528.3	277.9

[1]Personnel compensation total index based on weighted average as follows: professional salaries, 68.21 percent; nonprofessional wages and salaries, 21.34 percent; and fringe benefits, 10.45 percent.

[2]Contracted services, supplies, and equipment total index based on weighted average as follows: services, 48.5 percent; supplies and materials, 21.2 percent; and equipment, 30.3 percent.

[3]R&D Price Index based on weighted average as follows: personnel compensation, 67.0 percent (professional salaries, 45.7 percent; nonprofessional wages and salaries, 14.3 percent; and fringe benefits, 7.0 percent); contracted services, supplies, and equipment, 33.0 percent (services, 16.0 percent; supplies and material, 7.0 percent; and equipment, 10.0 percent).

Contracted services, supplies, and equipment					Annual percent increase over previous year	Fiscal year
Services (4.0)	Supplies and materials (5.0)	Equipment (6.0)	Total[2]	R&DPI[3]		
82.4	96.5	92.3	88.4	79.1	...	1961
84.6	95.9	92.6	89.4	81.4	2.9	1962
86.8	95.6	93.1	90.6	84.2	3.4	1963
89.3	95.8	94.0	92.1	87.3	3.7	1964
92.5	96.3	95.1	94.1	90.8	4.0	1965
95.6	98.2	97.2	96.6	94.7	4.3	1966
100.0	100.0	100.0	100.0	100.0	5.6	1967
104.8	101.4	103.0	103.5	105.5	5.5	1968
110.5	103.3	106.8	107.9	112.3	6.5	1969
117.1	106.1	112.1	113.3	119.3	6.2	1970
124.5	110.1	116.5	119.0	126.2	5.9	1971
131.3	112.6	121.4	124.3	133.0	5.4	1972
137.4	117.3	125.5	129.6	139.2	4.7	1973
144.4	134.0	133.9	139.0	148.2	6.5	1974
154.4	168.8	163.7	160.3	162.1	9.4	1975
165.3	176.8	173.6	170.3	173.6	7.1	1976
175.4	186.2	182.5	179.8	184.4	6.2	1977
187.2	193.6	196.0	191.2	196.3	6.5	1978
200.0	209.3	212.6	205.8	211.6	7.8	1979
218.9	247.3	234.3	229.6	230.7	9.0	1980
245.7	279.2	258.3	256.6	255.4	10.7	1981
272.0	292.1	279.2	278.4	278.1	8.9	1982

Table IV-5

Composition by object category of current direct expenditures for sponsored research and development in universities, estimate for fiscal year 1972.

Category		Percent of total expenditures	
Personnel compensation			67.0
1.0 Professional salaries		45.7	
1.1 Faculty (university)	17.3		
1.2 Research associates	15.1		
1.3 Graduate assistants	10.2		
1.4 Other professional, nondoctoral	3.1		
2.0 Nonprofessional wages and salaries		14.3	
2.1 Technicians	7.0		
2.2 Craftsmen	2.4		
2.3 Clerical	2.4		
2.4 Students	2.5		
3.0 Fringe benefits		7.0	
Contracted services, supplies, and equipment			33.0
4.0 Services		16.0	
4.1 Data processing and equipment rental	2.9		
4.2 Communication	.8		
4.3 Transportation	2.0		
4.4 Printing and duplication	.8		
4.5 Miscellaneous services	8.4		
4.6 Consultants and other professional	1.1		
5.0 Supplies and materials		7.0	
6.0 Equipment		10.0	
		100.0	100.0

have been used as representative of the trend of compensation for faculty participants in academic research. With about 88 percent (1972-73) of sponsored R&D expenditures accounted for by universities, trends relating to compensation of *university* faculty, as opposed to all faculty, are most relevant for the R&D price index. For this reason, the AAUP Category I salary data for approximately 150 universities are used. Category I "includes institutions which offer the doctorate degree and which conferred in the most recent three years an annual average of fifteen or more earned doctorates covering a minimum of three nonrelated disciplines."

There is some concern as to the validity of using the trend in salaries of all university faculty as the appropriate surrogate for faculty engaged in sponsored research who are primarily in the *sciences*. Science and

engineering departments have been relatively affluent in recent years and may have increased their faculty salaries within rank classifications at a greater rate than for all faculty combined. If this is true, the AAUP salary data would miss part of an additional rise in salaries that may have occurred separately for science and engineering faculty engaged in R&D projects.

1.2 Research associates

Research associates engaged in academic research are a unique factor. These are professional scientists or engineers serving as senior research associates or more often as postdoctorals without faculty rank or prerequisites. Their attachment to the university is generally marginal, although research appointments may be stepping stones to more permanent affiliations.

With only fragmentary and inconclusive information as guides, the selection of proxy trends to represent compensation of research associates is a difficult problem and one that at this stage must be judgmental. Since research associates are academically oriented and are generally full-time employees, it is reasonable to assume that their compensation is related to the salary and compensation scales of faculty. Such an assumption is particularly cogent with respect to senior research associates working primarily in a professional capacity, less true for postdoctorals whose research participation represents a continuation of their educational training. The stipends of postdoctorals, who make up the bulk of research associates, is considerably less than the salaries of assistant professors.[7] For these reasons, AAUP data for university (Category I) instructors have been selected as the most appropriate proxy for salaries of research associates.

1.3 Graduate assistants

See page 57 for discussion of graduate research assistants and table IV-6 for price series.

1.4 Other professional, nondoctoral

This category includes auxiliary research personnel and technicians who provide services to the principal investigators and research associates. Support services are generally outside the professional interests (or training) of the faculty, research associates, and graduate students, and therefore it seems logical to assume that compensation paid to such auxiliary research personnel would be determined by competitive conditions for their specializations in the general labor market.

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[7] See National Academy of Sciences, *The Invisible University: Postdoctoral Education in the United States*, Washington, D.C., 1969, pp. 226-227.

Table IV-6

Indexes of salaries of professional personnel used for the Research and Development Price Index, fiscal years 1961-1982.

1967 = 100 **(Number code in parentheses identifies category as outlined in table IV-5.)**

Fiscal year	Faculty (university) (1.1)	Research associates (1.2)	Graduate assistants (1.3)	Other professional, nondoctoral			Professional salaries total[2] (1.0)
				Chemists	Engineers	Total[1] (1.4)	
1961 ...	72.5	76.0	76.0	79.0	81.3	80.2	75.0
1962 ...	75.9	78.4	78.4	82.1	83.4	82.8	77.8
1963 ...	79.6	82.4	82.4	85.2	87.1	86.2	81.6
1964 ...	84.5	86.2	86.2	88.0	89.6	88.8	85.7
1965 ...	89.1	90.2	90.2	91.4	92.5	92.0	89.9
1966 ...	93.8	93.6	93.6	95.8	95.9	95.9	93.8
1967 ...	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1968 ...	106.6	105.9	105.9	105.1	105.4	105.3	106.1
1969 ...	113.0	112.8	112.8	111.9	111.9	111.9	112.8
1970 ...	119.6	120.2	120.2	118.5	118.1	118.3	119.8
1971 ...	126.1	125.8	125.8	125.0	124.8	124.9	125.9
1972 ...	130.6	132.4	132.4	131.4	131.3	131.4	131.6
1973 ...	134.8	136.8	136.8	136.3	138.0	137.0	136.1
1974 ...	141.2	142.8	142.8	146.0	145.5	145.8	142.4
1975 ...	148.6	151.0	151.0	160.7	157.7	159.2	150.6
1976 ...	158.1	160.9	160.9	171.3	168.4	169.9	160.5
1977 ...	166.0	169.7	169.7	183.3	179.2	181.3	169.1
1978 ...	174.4	178.5	178.5	199.8	195.3	197.6	178.2
1979 ...	185.6	188.9	188.9	215.0	211.7	213.4	189.3
1980 ...	198.3	198.6	198.6	236.1	232.4	234.3	200.9
1981 ...	216.7	217.8	217.8	258.3	257.7	258.0	220.1
1982 ...	236.0	231.6	231.6	285.2	284.0	284.6	236.9

[1]Other professional, nondoctoral total index based on equally weighted average of chemist and engineer salaries.

[2]Professional salaries total index based on weighted average as follows: faculty, 37.9 percent; research associates, 33.0 percent; graduate assistants, 22.3 percent; and other professional, nondoctoral, 6.8 percent.

Sources: American Association of University Professors and U.S. Department of Commerce, Bureau of Labor Statistics.

As an approximation of these market conditions, a composite trend of salaries for chemists and engineers published in the BLS reports on its annual *National Survey of Professional Administrative, Technical and Clerical Pay* (PATC) is used as a surrogate for this category (see table IV-6).

2.0 Nonprofessional wages and salaries

For nonprofessional categories 2.1 *Technicians*, 2.2 *Craftsmen*, 2.3 *Clerical*, and 2.4 *Students*, see pp. 63-69 for discussion and table III-8 for price series.

3.0 Fringe benefits

See pp. 69-72 for discussion and table IV-4 for price series.

CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT

4.0 Services

For service components 4.1 *Data processing and equipment rental*, 4.2 *Communication*, 4.3 *Transportation*, 4.4 *Printing and binding*, and 4.5 *Miscellaneous service*, see pp. 73-77 for discussion and table III-10 for price series.

4.6 Consultants and other professional

Consultants (mostly faculty from other institutions contracted on an honoraria basis) and experts from business and industry hired to provide professional services to the research activity have been priced by the composite index for university faculty compensation. See table III-10 for price series.

5.0 Supplies and materials

See pp. 77-78 for discussion and table IV-4 for price series.

6.0 Equipment

See pp. 78-79 for discussion and table IV-4 for price series.

Table IV-7

Indexes and dollar amounts of university[1] faculty salaries,[2] by rank, fiscal years 1961-1982.

1967 = 100 (Number code in parentheses identifies category as outlined in table IV-5.)

Fiscal year	Professors		Associate professors	
	Amount	Index	Amount	Index
1961	$11,160	71.5	$ 8,300	73.0
1962	11,710	75.0	8,660	76.2
1963	12,270	78.6	9,090	79.9
1964	13,140	84.2	9,600	84.4
1965	13,880	88.9	10,150	89.3
1966	14,640	93.8	10,670	93.8
1967	15,610	100.0	11,370	100.0
1968	16,640	106.6	12,120	106.6
1969	17,600	112.7	12,910	113.5
1970	18,600	119.2	13,630	119.9
1971	19,600	125.6	14,380	126.5
1972	20,250	129.7	14,920	131.2
1973	20,900	133.9	15,380	135.3
1974	21,900	140.3	16,130	141.9
1975	23,100	148.0	16,950	149.1
1976	24,590	157.5	18,060	158.8
1977	25,820	165.4	18,963	166.7
1978[4]	26,860	173.8	19,800	175.2
1979	28,580	184.9	21,140	187.1
1980	30,730	198.8	22,560	199.6
1981[5]	33,450	216.7	24,560	217.9
1982	36,500	236.5	27,710	245.8

[1]Approximately 150 universities in Category 1, which "includes institutions which offer the doctorate degree and which conferred in the most recent 3 years an annual average of 15 or more earned doctorates covering a minimum of three nonrelated disciplines."

[2]Average salary for full-time faculty based on standard 9-month academic-year.

[3]Weighted average based on the proportion of total faculty salaries paid in 1971-72 to each academic rank engaged in R&D as follows: professors, 44.3 percent; associate professors, 28.8 percent; assistant professors, 22.7 percent; and instructors, 4.2 percent.

[4]Beginning in 1978, faculty salaries and fringe benefits are based on a substantially larger sample so that the fiscal year 1978 dollar amount data are not comparable to earlier years. However, the fiscal year 1978 indexes are based on a constant sample of institutions reporting comparable data for both fiscal years 1977 and 1978, and therefore continue the index series without distortion.

[5]Beginning in 1981, salaries are for all reporting institutions rather than the slightly smaller universe of institutions reporting comparable data. 1981 data are linked to the previous series in 1980.

Assistant professors		Instructors		Faculty total (universities) index[3] (1.1)	Fiscal year
Amount	Index	Amount	Index		
$ 6,800	73.1	$ 5,450	76.0	72.5	1961
7,120	76.6	5,620	78.4	75.9	1962
7,490	80.5	5,910	82.0	79.6	1963
7,880	84.7	6,180	86.2	84.5	1964
8,290	89.1	6,470	90.2	89.1	1965
8,720	93.8	6,710	93.6	93.8	1966
9,300	100.0	7,170	100.0	100.0	1967
9,940	106.9	7,590	105.9	106.6	1968
10,530	113.2	8,090	112.8	113.0	1969
11,160	120.0	8,620	120.2	119.6	1970
11,760	126.5	9,020	125.8	126.1	1971
12,200	131.2	9,490	132.4	130.6	1972
12,610	135.6	9,810	136.8	134.8	1973
13,190	141.8	10,240	142.8	141.2	1974
13,830	148.7	10,830	151.0	148.6	1975
14,670	157.7	11,540	160.9	158.1	1976
15,418	165.7	12,175	169.7	166.0	1977
16,080	173.7	12,860	178.5	174.4	1978
17,120	184.9	13,610	188.9	185.6	1979
18,210	196.7	14,310	198.6	198.3	1980
19,850	214.8	15,630	217.8	216.7	1981
21,910	237.0	16,620	231.6	236.0	1982

Source: *Annual Report on the Economic Status of the Profession.*

V. COLLEGE AND UNIVERSITY PHYSICAL PLANT ADDITIONS PRICE INDEXES

Since 1961, expenditures for new construction have increased 3.7 times at public colleges and universities and 3.0 times in the private sector, totalling $3.4 billion in 1980. Most of this growth took place in the early sixties, to accommodate the gigantic growth in enrollments, and was spurred by new construction grants and loans provided by the Federal Government.

Although near-level new construction spending since 1967 of about $3 billion a year (± 10 percent) appears to be substantial sustained support, when enrollment growth and inflation are taken into account the picture changes drastically. In constant dollars per student, expenditures for new construction have declined dramatically, from a peak of $577 in 1967 to $146 per student in 1980.

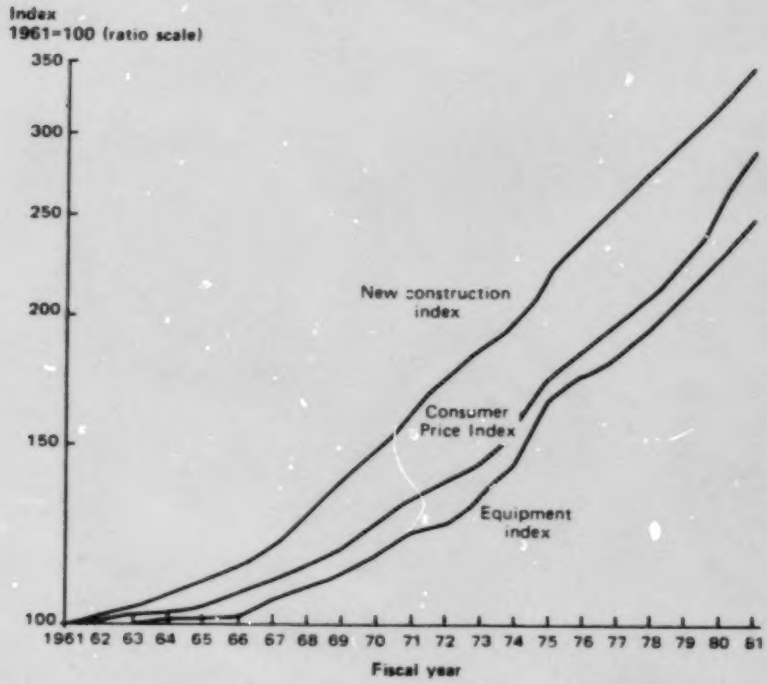
The key to analyzing trends in college and university building construction is a suitable price deflator. The index used for this purpose, plus a price index for physical plant equipment, are presented in the second section of this chapter, followed by a discussion of how improvements in construction technology are taken into account in index compilation and the alternatives considered in selecting an index. The analysis below presents price trends in building construction and in equipment and the impact of these trends on the expenditures of colleges and universities for physical facilities.

The Effects of Inflation on Physical Plant Additions

The price trends for building construction and for equipment purchased by colleges and universities compared with the Consumer Price Index is shown in figure V-1. Since 1961, the price of new construction has increased at an annual rate of 6.5 percent, slightly greater than the 6.2 percent annual increase in the price colleges and universities are paying for current operations. The prices of equipment purchased through plant expenditures rose only 4.7 percent yearly between 1961 and 1981,

Figure V-1

Comparison of trends in price change in higher education building construction and equipment with the Consumer Price Index, fiscal years 1961-1981.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

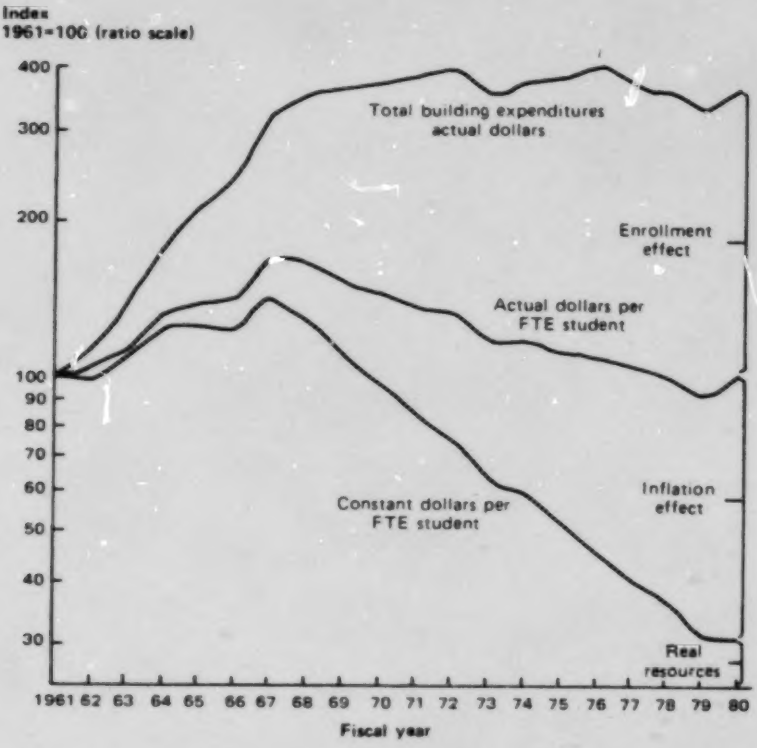
although in the last few years they have jumped 8+ percent reflecting the national inflation phenomenon.

The effect of price increases on expenditures for new construction are shown in table V-1 and in figures V-2 and V-3. The rapid expansion of college and university facilities in the sixties reached its peak in 1967, with expenditures for new construction equaling $577 per student. In both the public and private sectors, the $577 represented the most real resources (on a unit basis) ever devoted to new construction, and this number likely will not be exceeded.

Since 1967, total new construction expenditures in the public sector have gradually increased, but not as fast as enrollment growth or prices.

Figure V-2

Trends in plant fund expenditures for buildings in public institutions, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1980.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

The result has been a steady decline in per student real investment, from a high of $558 in 1967 to a low of $125 in 1980 (in amounts based on 1967 prices). The private sector has fared about the same. While total expenditures have declined, enrollment growth has not been as great, with per-student constant dollar expenditures dropping from a high of $617 in 1967 to a 1979 low of $144 (1967 prices). The apparent resurgence in 1980 has yet to be verified. Changes in reporting procedures by institutions may have caused the increase. However, the National Center for Educa-

Table V-1

Plant fund expenditures for buildings by control of institution, amount and amount per FTE student in actual and constant dollars, fiscal years 1960-1980.

Fiscal year	All institutions				Public institutions			
	Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]
1960	$ 886	$...	$315	$...	$ 548	$...	$329	$...
1961[2]	995	1,193	332	398	585	701	328	393
1962	1,141	1,340	352	413	661	776	334	392
1963[2]	1,360	1,560	388	445	810	929	372	427
1964	1,655	1,851	441	493	1,030	1,153	432	483
1965[2]	1,975	2,144	473	513	1,230	1,336	454	492
1966	2,343	2,454	493	516	1,448	1,516	459	480
1967	2,969	2,969	577	577	1,918	1,918	558	558
1968	3,157	2,942	570	531	2,066	1,925	543	506
1969[2]	3,185	2,758	529	458	2,140	1,853	500	433
1970	3,174	2,580	497	401	2,206	1,779	478	386
1971	3,143	2,333	463	344	2,247	1,669	451	334
1972	3,179	2,182	448	308	2,316	1,590	438	301
1973	2,840	1,835	396	255	2,086	1,348	388	251
1974	3,020	1,827	401	243	2,203	1,333	388	235
1975	3,106	1,683	394	214	2,246	1,217	375	203
1976	3,133	1,577	366	184	2,365	1,190	380	181
1977	3,046	1,413	362	168	2,208	1,025	345	160
1978	2,894	1,253	339	147	2,117	916	328	142
1979	2,707	1,096	319	129	1,944	787	306	124
1980	3,369	1,260	391	146	2,149	804	334	125

[1]Constant dollars in 1967 prices.

[2]Amounts estimated.

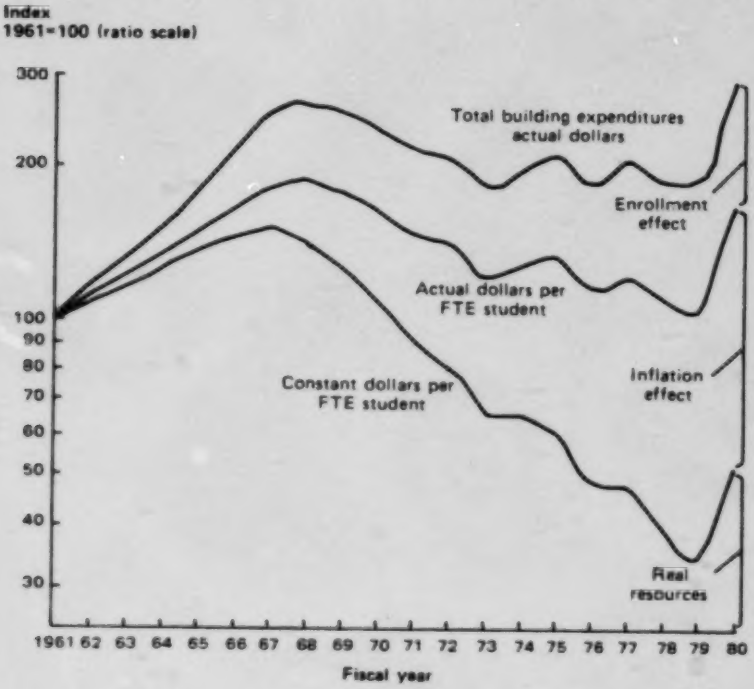
Note: Included with plant fund expenditures for buildings are additions by gift-in-kind from donor and by reappraisal of building value and other additions. These additions are generally less than 10 percent of the total. Included in building expenditures are expenditures for fixed equipment and for such improvements as utility lines, landscaping, and the like.

Source: U.S. Department of Education, National Center for Education Statistics, *Financial Statistics of Institutions of Higher Education*, relevant issues.

Private institutions					
Amount (in millions)			Per FTE student		Fiscal year
Actual dollars	Constant dollars[1]		Actual dollars	Constant dollars[1]	
$ 339	$...		$296	$...	1960
410	492		339	406	1961
480	563		379	445	1962
550	631		414	474	1963
624	698		457	511	1964
745	809		508	552	1965
895	937		560	587	1966
1,041	1,041		617	617	1967
1,091	1,017		629	586	1968
1,045	905		599	518	1969
967	780		548	442	1970
895	665		497	369	1971
863	592		477	327	1972
754	487		417	269	1973
815	494		441	267	1974
860	466		455	247	1975
768	387		392	197	1976
838	389		418	194	1977
777	336		374	162	1978
763	309		357	144	1979
1,220	456		564	211	1980

Figure V-3

Trends in plant fund expenditures for buildings in private institutions, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1980.



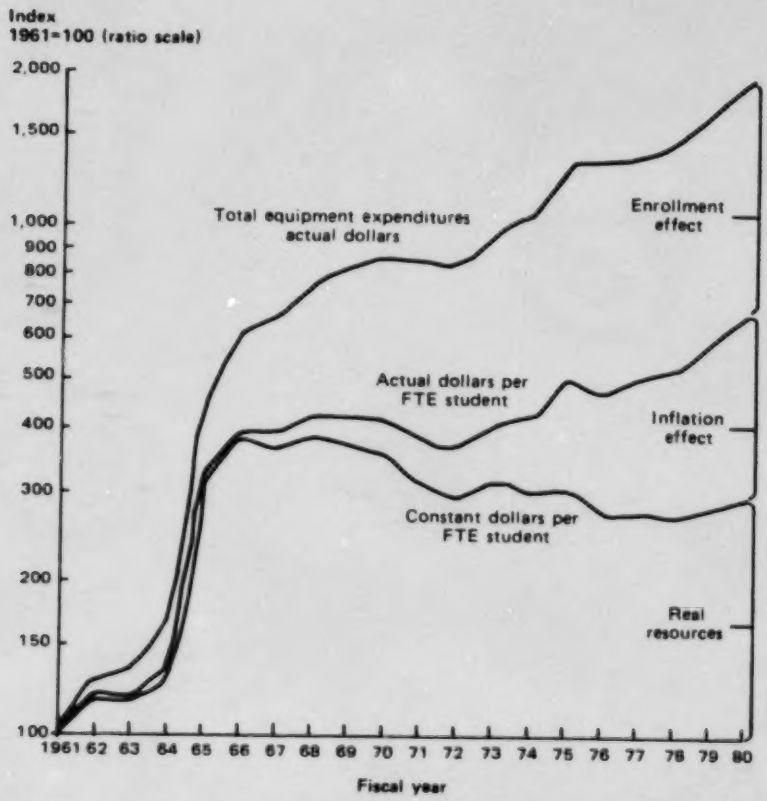
Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal distances reflect equal proportional (as distinguished from absolute) changes.

tion Statistics is withholding final verification of the 1980 data until confirmed by the 1981 survey.

Until 1974, equipment purchases were a "good buy" relative to the prices of other goods and services, which had been rising more rapidly (see figure III-2). Equipment expenditure data are presented in table V-2 and figure V-4. In constant dollars, unit expenditures at public institutions peaked at $139 (1967 prices) in 1968 and slowly declined to the current $198 per student level. In the private sector, a similar decline has taken place with the exception of a large increase in 1980 that parallels the previously cited unusual and unverified increase in new construction at private institutions.

Figure V-4

Plant fund expenditures for equipment in institutions of higher education, amount and amount per FTE student in actual and constant dollars, fiscal years 1961-1980.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

The decline in real investment in equipment has been much less than that in new construction. Education overbuilt facilities in the 1960's, which lessened the need for further new construction, while requirements for new equipment and replacements continued steady. Although the same proportion of actual dollars went to each, real investment in equipment relative to new construction increased due to lower price increases and the intention of planners to emphasize equipment rather than

Table V-2

Plant fund expenditures for equipment by control of institution, amount and amount per FTE student in actual and constant dollars, fiscal years 1960-1980.

Fiscal year	All institutions				Public institutions			
	Amount (in millions)		Per FTE student		Amount (in millions)		Per FTE student	
	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]
1960	$ 92	$...	$ 33	$...	$ 51	$...	$ 31	$...
1961[2]	100	106	33	35	55	59	31	33
1962	128	136	39	41	68	72	35	37
1963[2]	135	143	39	41	75	79	34	36
1964	166	175	44	46	89	94	37	39
1965[2]	445	467	106	111	300	315	111	116
1966	612	635	129	134	421	437	133	138
1967	663	663	129	129	463	463	135	135
1968	775	752	140	136	543	527	143	139
1969[2]	840	794	139	131	610	577	143	135
1970	874	792	137	124	652	591	141	128
1971	867	751	128	111	668	578	134	116
1972	866	735	122	103	670	568	127	108
1973	970	798	135	111	744	612	138	114
1974	1,053	804	140	107	817	624	144	110
1975	1,324	847	168	107	967	618	161	103
1976	1,344	820	157	96	1,019	621	155	95
1977	1,392	809	166	97	1,026	597	160	93
1978	1,487	809	174	95	1,087	591	169	92
1979	1,662	836	196	99	1,279	643	201	101
1980	1,922	893	223	104	1,354	629	210	98

[1]Constant dollars in 1967 prices.

[2]Amounts estimated.

Note: Included with plant fund expenditures for equipment are additions by gift-in-kind from donor and by reappraisal of equipment value and other additions. These additions are generally less than 10 percent of the total.

Source: U.S. Department of Education, National Center for Education Statistics, *Financial Statistics of Institutions of Higher Education*, relevant issues.

buildings. With the trend in all prices up sharply, future equipment expenditures will buy less than in the past. And the continued purchase of more costly improved equipment compounds the problem. The equipment price index measures price change for a market basket of products

Private institutions				
Amount (in millions)		Per FTE student		Fiscal year
Actual dollars	Constant dollars[1]	Actual dollars	Constant dollars[1]	
$ 41	$...	$ 36	$...	1960
45	48	37	39	1961
59	63	47	50	1962
60	63	45	48	1963
77	81	56	59	1964
145	152	99	104	1965
191	198	120	125	1966
201	201	119	119	1967
232	225	134	130	1968
230	217	132	125	1969
222	201	126	114	1970
198	171	110	95	1971
196	166	109	92	1972
226	186	125	103	1973
236	180	127	97	1974
357	228	189	121	1975
325	198	163	99	1976
366	213	182	106	1977
400	218	192	104	1978
383	193	179	90	1979
568	264	263	122	1980

fixed in design and quality. Institutions that substitute more expensive advanced equipment must add to their total budget the additional cost involved.

Description of Indexes and Data Base

The price index for physical plant fund expenditures is the "Index of Change in Prices of Building Construction and Equipment Purchases by Colleges and Universities Through Plant Fund Expenditures." Expenditures for physical plant assets consist primarily of investment in buildings and equipment. Land purchases represent less than 4 percent of the total. Because geographical locale plays a critical role in land values, a land expenditure price series based on national averages would have no relevancy either to a particular plot or to a given institution or group of institutions. Therefore, land as an item of expenditure is excluded from the index calculation.

Since 1965-66, total plant expenditures have been proportioned between those for new building construction and those for equipment at a remarkably consistent 79 percent/21 percent split. These weights are used in computing the index for physical plant fund expenditures presented in table V-3. However, in 1972-73 this ratio changed to 75 percent/25 percent. If 1973-74 data suggest continuation of this ratio or a general trend, the index will be reweighted accordingly.

New Construction

Colleges and universities construct many different types of buildings, but generally they are large steel or concrete structures similar to commercial office buildings. Based on physical facility inventories, about half the floor area of campus buildings is devoted to academic facilities that include classrooms, laboratories, offices, and study areas. Twenty percent of the floor area is for general and supporting use such as museums, hotel-type accommodations, auditoriums, theaters, garages, power and heating plants, and teaching hospitals. Thirty percent is for residential facilities.

Although there is no construction price index designed specifically for institutions of higher education, the Boeckh Division of the American Appraisal Company does compute an index for apartments, hotels, and office buildings. This index appears applicable to the mix and types of buildings found on college and university campuses.[1] The Boeckh index also appears superior to other alternatives in accounting for improvements in construction productivity. A discussion of this topic and other factors which led to choice of the Boeckh index begin on page 102. Boeckh index values for new construction are presented in table V-3.

The Boeckh index for apartments, hotels, and office buildings is a fixed weight input index of wage rates and building material prices

[1]Boeckh has the data and capability to develop a construction price index exclusively for structures built by the colleges and universities. Demand for such an index has not been sufficient to warrant its development and maintenance.

Table V-3

Price index of building construction and equipment purchased by colleges and universities, and component subindexes, fiscal years 1961-1982.

1967 = 100

Fiscal year	New construction index	Equipment index[1]	Construction and equipment price index[2]
1961	83.4	94.0	85.6
1962	85.2	94.0	87.0
1963	87.2	94.5	88.7
1964	89.4	95.1	90.6
1965	92.1	95.3	92.8
1966	95.5	96.3	95.7
1967	100.0	100.0	100.0
1968	107.3	103.1	106.4
1969	115.5	105.8	113.5
1970	124.0	110.4	121.1
1971	134.7	115.5	130.7
1972	145.7	117.9	139.9
1973	154.8	121.5	147.6
1974	165.3	131.0	158.0
1975	184.5	156.4	179.0
1976	198.7	164.0	191.6
1977	215.5	172.0	206.3
1978	231.0	183.9	221.0
1979	246.9	198.8	236.8
1980	267.3	215.2	256.3
1981	293.2	234.2	280.7
1982	322.4	251.5	307.1

[1]Weighted average of the following items from the Wholesale Price Index network: commercial furniture, 40 percent; office and store machines and equipment, 25 percent; general purpose machinery and equipment, 30 percent; and machinery and equipment, 5 percent.

[2]Weighted average through FY 1972: new construction, 79 percent; equipment, 21 percent. Weighted average beginning in FY 1973 and linked to the earlier price series in FY 1972: new construction, 74 percent; equipment, 26 percent.

Source: For building construction, the Boeckh apartments, hotels, and office buildings index compiled by the Boeckh Division of the American Appraisal Company, Inc., and reported in *Construction Review*, published monthly by the U.S. Department of Commerce.

weighted together in accordance with their importance to the cost of a unit of construction in the 1967 base period. It covers the structural portion of buildings and all plumbing, heating, lighting, and elevators. The index measures construction with fixed specifications, and the bill of 55

material items is extremely thorough.[2] Wage rates are based on detailed job specifications for 19 construction occupations.[3] The weights assigned to the various wage rates and building material prices represent actual final total building expenditures reported in "Contractor's Sworn Statements" (CSS). These statements are continually monitored by Boeckh; as changes occur in construction procedures and material (occasionally with resulting improvements in construction productivity), index component weights are modified, with index values adjusted to eliminate the effects of such changes. The material-labor weights, constant since 1967, are: material, 51.7 percent; labor, including contractor's overhead, profit, and contingency funding, 48.3 percent.

Material and labor costs are computed monthly based on actual transaction prices paid. For basic building materials (brick, concrete block, lumber, ready-mix concrete, galvanized sheet metal, and reinforced and structural steel), Boeckh collects local prices. The balance of material items are priced using Wholesale Price Index price series. Local *Blue Book* prices are used for rental of trucks, excavation and erection equipment, and for elevator fabrication. Wage rates including fringe benefits are gathered every other month in 187 U.S. cities and in 19 Canadian cities. Boeckh reports some geographical differentials in worker productivity but does not recognize any national trend over time.

Equipment

Equipment purchased through capital investment of plan funds generally consists of all types of movable property of a permanent nature, much of which is purchased for immediate installation in new buildings. Permanently affixed furniture, machinery, appurtenances, and appliances constructed as part of the building are not classified as equipment.[4] Current fund, as opposed to plant fund, expenditures for

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[2]Major material items in the Boeckh index include brick, concrete block, lumber, ready-mix concrete, galvanized sheet metal, reinforced steel and structural steel, acoustical tile fiber, doors and frames, glass windows, hardware, fiber board, metal lath, Indiana limestone, marble, metal strips, paint, gypsum, roofing asphalt, channels light steel, resilient flow tiling, ceramic wall tile, sash, copper tubing, lavatories, water closets, pipe cast iron and black steel, elevator materials, air conditioners, boilers, furnace forced air control systems, pipe galvanized steel, radiators, unit heaters, electrical conduit, fixtures, switch gear, transformers, and cable.

[3]Construction occupations priced by the Boeckh index are: bricklayer, carpenter, concrete laborer, concrete formwork laborer, electrician, shovel operating engineer, building laborer B and C, mason tender, painter, plasterer, plumber, ironworker, rod man, composition roofer, sheet metal worker, sheet metal duct worker, structural steelworker, structural steel fabricator, and truckdriver.

[4]This includes: built-in laboratory tables, lockers, bookcases; boilers, furnaces, fixtures, and machinery for heating, lighting, plumbing, air conditioning, and other power plant equipment; elevators; vaults and conduits; signal and clock systems; utility systems; and compressed air systems. American Council on Education, *College and University Business Administration*, Washington, D.C., 1968, p. 108.

equipment, discussed on page 78, usually involve small items added to the equipment inventory subsequent and apart from the building construction program.

The need for holding constant the quality or utility-determining specifications of all items in collecting price data to be used in price indexes has already been emphasized. With regard to much equipment, such a practice is especially difficult and perhaps impossible. The utility of most products is continuously being modified and improved, and the improved product usually is sold at a higher price to the consumer. Any change in producer costs or sale price that can be attributed to a change in product quality must not be considered a price change. Another problem in developing a price index for equipment is that colleges and universities purchase a variety of products. Individual pricing of these many products is not feasible.

The task of pricing many different product items while accounting for the effects on price of product innovation and redesign is performed by the Bureau of Labor Statistics in preparing the Producer Price Index. To avoid incorporating price changes influenced by quality or quantity changes, BLS defines each commodity in the Producer Price Index by precise specifications that incorporate their principal price-determining characteristics.[5] So far as possible, prices are f.o.b. producing point and refer to sales in large quantities for immediate delivery.

Although the PPI is based on more than 2,500 commodities and over 8,000 price quotations, it is only a sample of all commodities sold in commercial transactions in primary markets. The items priced are thus representative of all items in the PPI universe. For the many types of equipment purchased by colleges and universities, a representative sample for pricing must also be used. Many of the major types of equipment expenditures made by colleges and universities are subindex components of the PPI. If the PPI sampling for these subindexes is also representative of equipment items purchased by colleges, then the PPI price series may serve as an appropriate proxy. This assumption has been made, and four BLS subindexes that represent the major types of equipment purchased by colleges and universities are listed below.

Equipment type	Relative weight[1]	PPI subindexes used
	Percent	
Office and classroom furniture . . .	40	Commercial furniture (BLS No. 122—includes chairs, desks, and filing cabinets).

[5] An example of a commodity specification for steel strip is: "Strip, cold-rolled, carbon steel, coils, No. 4 temper, No. 2 finish, No. 3 edge, base chemistry, 6" × 050", in quantities of 10,000 to 19,999 lb., mill to user, f.o.b. mill, per 100 lb."

Equipment type	Relative weight[1]	PPI subindexes used
Office machines and equipment . .	25	Office and store machines and equipment (BLS No. 1193— includes calculators, adding machines, typewriters, safes, duplicating machines, and cash registers).
Laboratory equipment	30	General purpose machinery and equipment (BLS No. 114—includes pumps, compressors, conveyors, mechanical power transmissions, scales and balances, fans and blowers, valves and fittings, and bearings).
Other	5	Machinery and equipment (BLS No. 11—includes agricultural, construction, metalworking, woodworking, printing, and general purpose machinery and equipment).

[1]The relative weight of each equipment component is based on data obtained from college purchasing officers.

Construction Productivity and Index Selection

The privately compiled price indexes used by the Bureau of the Census and others to deflate figures for new construction have been widely criticized on the grounds that they do not account for productivity changes and therefore overstate price increases. In January 1961, as part of its overall review of price indexes, the Price Statistics Review Committee of the National Bureau of Economic Research described this and other major deficiencies and recommended that the development of statistically adequate construction price indexes be given a high priority in the Federal Government's price statistics efforts.[6] Followup activities on the Committee's recommendations were reported in the *Survey of Current Business.*[7] Revised deflators were selected by the Bureau of Economic Analysis (BEA) and the Bureau of the Census. However, in the opinion of this observer, none of those selected are relevant and therefore appropriate as price indexes for college and university construction. Thus, an alternative index has been chosen for this purpose.

[6]The Price Statistics Review Committee was organized by the National Bureau of Economic Research at the request of the Bureau of the Budget. The Committee's report is given in: U.S. Congress, Joint Economic Committee, *Government Price Statistics Hearings..., January 24, 1961.*

[7]Bureau of Economic Analysis (BEA) and the Bureau of the Census, Social and Economic Statistics Administration, U.S. Department of Commerce, "Revised Deflators for New Construction, 1947-73," *Survey of Current Business,* Vol. 54, No. 8, Part I, August 1974, pp. 18-27.

Accounting for Increased Productivity

The proper measure of price change in construction is conceptually somewhat different than that normally used in preparing price indexes. The essence of price measurement is that a time series of price observations be obtained for goods and services of fixed specifications. For homogeneous raw materials of near constant quality (coal, sugar, lumber), quality can be easily controlled by imposing detailed specifications. For the many products that continually change in quality (typewriters, jackets, automobiles), the difference in price because of change in quality (as measured by related higher producer costs or the difference in price between the two qualities produced and sold simultaneously) can be properly excluded by the linking process.

However, new construction is one of the more heterogeneous products in the economy, with houses (except tract housing), buildings, and shopping centers seldom built the same. This necessitates pricing a fixed hypothetical building that accurately represents the type or category of construction being considered. Furthermore, because no "standard" building is constructed year-after-year, inputs (labor and material) rather than the finished building product must be priced.

In pricing inputs, special attention must be directed to those changes in labor and material that result in increased construction productivity. As technology develops new tools, procedures, and materials, construction can be performed at lower unit costs. A construction price index, although based on inputs, must report the cost of a *completed* structure, taking into account all improvements in productivity brought about by changes in inputs and the efficiency of their use.

Changes in productivity are equal to the difference in input costs between old and new methods *measured per unit on the completed or in-place component.* An example will illustrate. The efficiency of interior wall construction has been increased by use of drywall board instead of plaster. The difference in unit costs ($0.40/square foot compared to $0.51/square foot in 1972) would be accounted for in index values by substituting the labor costs per square foot of completed wall of "rockers" and "finishers" for "lathers" and "plasterers," as well as the unit costs of sheetrock and finishing compound for gypsum board and brown and finished coat plaster. The fact that a finished plaster wall has certain quality aspects superior to those of drywall would have to be taken into account.

Selection of the Boeckh Index

The revised construction deflators selected on an interim basis by the BEA and Census are based, by necessity, on existing price series with

their attendant deficiencies. For educational, hospital and institutional, religious, and other nonfarm nonresidential buildings, the BEA and Census have selected an unweighted average (one-third weight each) composite of the Turner Construction Company's index, the Census' single-family house index, and the Federal Housing Administration's (FHA's) structures index. This composite index also serves as a construction deflator for industrial buildings, commercial buildings, and farm nonresidential buildings.

The wide range of building types covered by this single index explains in part why three distinctive price series were selected to form a composite: to represent as many physical specifications and construction skills as would be found in such a broad spectrum of buildings. There is little difference in the overall rate of increase between the BEA's and the Census' revised deflator for nonresidential buildings and the Boeckh index selected for college and university construction (for the 1961-73 period 84.1 percent and 85.6 percent, respectively). Yet from a theoretical standpoint, the Boeckh index is preferable.

Consider the three components of the BEA-Census index as applied to nonresidential buildings. Both the Census' single-family house index and the FHA's structures index can be dismissed as irrelevant to most types of nonresidential building construction. Single-family houses are typically small, two-story, wood-framed constructions with simple electrical, air conditioning, and heating systems. Nonresidential commercial and institutional buildings, on the other hand, are large, multistory, steel and/or concrete frame structures with complex structural, mechanical, and electrical systems. The architectural and engineering designs are far more extensive, complex, and costly than are those for residential houses. Many workers on large constructions are highly skilled, and all are paid union commercial rates that exceed both nonunion wages commonly paid for residential house construction and union residential rates. It is also important to note that since the Census' single-family house index represents the *total* sales price of houses, including site values for use in the value-in-place series, the index must be adjusted for site-value changes. The difficulty of accurately estimating land values casts serious doubts on the validity of resulting structural values.

Bridge construction also is dissimilar to that of commercial buildings. The FHA's structures index is a weighted average based on the contract price of fixed physical quantities in place for reinforcing steel, structural steel, and structural concrete. The heavy types of equipment and materials used in bridge construction, particularly if the span is over water, the exceedingly sophisticated structural engineering required in many bridge designs, and the use of prestressed concrete in some instances are among the dissimilarities between bridge and building construction. This leads to rejection of the FHA's structures index as a suitable deflector component for nonresidential buildings.

The more relevant Turner Construction Index by itself would be a better deflator for nonresidential buildings than in combination with the other two components. Yet this index has certain deficiencies that suggest the superiority of the Boeckh index for the purposes intended here. In essence, beginning in 1970, the Turner Construction Company's building-cost index has been based on the estimated cost, plus profit, of constructing a hypothetical 40-story structural steel, finished office building of fixed specifications. The company's cost data are now derived from quarterly reports from the various regional Turner purchasing offices. These reports cover current and projected costs of about 12 categories of materials, supplemented by information on labor costs (from union contracts with Turner) and on other costs (such as interest on construction loans). Quarterly changes in the index are based on estimates of changes in materials, labor, and other costs, weighted according to their estimated relative importance in January 1970—labor, 38 percent; materials, 48 percent; other, 14 percent. Prior to 1969, the Turner index was based on the estimated cost of constructing a hypothetical reinforced-concrete, loft-type industrial building of 10 to 15 stories.

Both the Turner and Boeckh indexes are more similar than dissimilar. Choices of the Boeckh index, more a matter of degree than absolute superiority, rest primarily on its more detailed and comprehensive labor and material specifications and its broader and more representative collection of data. Equally important, the Boeckh index for apartments, hotels, and office building more closely parallels the types of buildings constructed on college and university campuses and therefore is more relevant. Turner's officials monitor construction operations and adjust costs to take account of the effects of productivity on the basis of informed judgment and by incorporating new materials and equipment in index compilation. The Boeckh index makes no value judgments as to changes in productivity, accounting for changes exclusively by altering material and labor inputs. This latter approach is viewed by this observer as adequate and superior—adequate as indicated by the fact that for the period of this study, 1961-81, the rate of growth of the Boeckh index has been less than that of the Turner index (293 percent versus 301 percent), and superior in avoiding subjective inclusions for which there are no standards or controls for consistency.

VI. STUDENT TUITION PRICE INDEXES

The tuition charged is an important factor in a student's decision to attend an institution. Likewise, tuition charged at nearby or peer institutions is important to college administrators in setting competitive rates. Tuition charges usually are published on an institutional basis, which permits college-by-college comparisons. Average values are of less general interest, and their use commonly has been limited to economists working on aggregate models of education financing.

But average charges *are* important to individuals. This information helps policymakers properly define the role of students in meeting the costs of education, and this is as important a matter in educational policy as the necessary consumer reimbursement for a purchased service. However decided, defining the role of student payment requires accurate information on existing charges grouped in meaningful aggregates.

Of unique value are national average tuitions in the form of price series, i.e., tuition charges weighted by fixed enrollments. Tuition price indexes so compiled reflect changes in average tuition due only to increases or decreases in the rates charged by institutions, and not changes brought about by shifts in enrollments. A tuition price index so compiled does *not* report average tuition paid except in the base year, when the enrollment weights equal actual enrollments.

Student Tuition Data Sources

The National Center for Education Statistics (NCES) publishes an institutional listing of undergraduate tuition and fees in its *Education Directory.* Tuition charges, as well as room and board charges, are also published by institution by the National Beta Club and by the College Scholarship Service (CSS) of the College Entrance Examination Board. The Life Insurance Marketing and Research Association annually publishes *College Costs,* which presents tuition, room and board, and undergraduate enrollment for most colleges and universities granting the bachelor's degree.

None of these organizations calculates a base-year, fixed-weight average (Laspeyres-type formula) necessary to present a true national average tuition price index. NCES, in its annual *Projections of Educational Statistics,* reports average student charges actually paid each year.

This average is determined by weighting each institution's charges by its current enrollment (Paasche-type formula). Shifts in enrollment, such as proportionately more students attending less expensive institutions, would affect average values weighted in this manner. The student-charge averages calculated by NCES thus measure more than pure price change and therefore do not represent an exact price index series.

CSS calculates an unweighted average of student charges—tuitions are simply added and divided by the total number of reporting institutions. Because there is such a tremendous range of institutional sizes, student charges must be weighted by enrollment if "averages" are intended to be representative of charges paid by most students. The 400 smallest private 4-year colleges, for example, have about one-half the total enrollment of the 100 largest colleges. A simple average would weight tuition charges at the smallest colleges 4 times that of charges at the largest colleges, when, in reality, the proper weighting based on enrollment would be 2 to 1 in favor of the larger institutions. The simple average of student charges calculated by CSS is thus unacceptable for pricing purposes.

In preparing the fixed-weighted national average tuition indexes presented here, the individual institutional tuition data collected by the Beta Club and the College Scholarship Service have been used. Only the Beta Club consistently reported the data required for the extended period 1960-61 through 1974-75. From this period to the present, CSS data have been used. Student-charge data, regardless of the collecting agency, often are inconsistently reported by institutions and require careful cross-checking. For this reason, the student-charge series for each institution has been revizwed and corrected by telephone contact to minimize reporting errors and maintain continuity.

Resident undergraduate tuition data have been prepared for public and private universities, 4-year colleges, and 2-year colleges and are presented in table VI-1. Prices for the entire 1961-82 time series are based on charges at the same institutions weighted with fixed 1967 enrollments. Composite tuition for all public and all private institutions has been computed, weighted according to the proportional enrollment of each type of institution. Prices have been calculated for fiscal years 1961, 1967, and 1974-82. Approximate values for the intervening years can be estimated by extrapolation. Based on sampling, and with some remaining concern for institutional reporting accuracy, the student charges presented in table VI-1 should be viewed as estimates.

Two factors dictated the sample of institutions used to represent national average data for each type of institution within the public and private sectors. First, to be included, institutions must have been in existence in 1960-61 and their student charges listed in the Beta Club's *College Facts Chart*. Second, institutions must have met arbitrary minimum 1967 enrollment requirements set to maximize student coverage and to exclude very small schools that may charge atypical tuition rates. The

public 4-year and 2-year institutions of California and the City University of New York (CUNY), which charge little or no tuition or nominal fees only, have been excluded. The resulting sample is shown below.

	Number of institutions			Student enrollment		
	1966-67 sample[1]	1966-67 universe	Sample as percent of institutional universe	1966-67 sample[2]	1966-67 universe[3]	Sample as percent of student universe
			Percent			Percent
Public						
Universities	93	93	100	1,530,000*	1,603,819*	95
4-year colleges[4] ...	165[5]	289	57	822,900	1,094,374	75
2-year colleges[6] ...	154[7]	398	39	442,300	650,617	68
Private						
Universities	65	65	100	644,100*	688,267*	94
4-year colleges	291[8]	1,112	26	606,700	1,176,937	52
2-year colleges	144[9]	276	52	89,300	135,970	66
Total	912	2,233	41	4,135,300	5,349,984	77

*Discrepancy due to difference in survey intent, definitions, and timing between the two collecting agencies—the National Beta Club and the U.S. Office of Education.

[1]Sample institutions existing in 1960-61 and listed in the National Beta Club's 1960-61 and 1966-67 *College Facts Chart.*

[2]Sample student enrollment based on headcount reported in the National Beta Club's 1966-67 *College Facts Chart.*

[3]Universe enrollments are resident students reported in U.S. Department of Health, Education, and Welfare, Office of Education, *Opening Fall Enrollment, Higher Education, 1966.*

[4]Excludes 18 California State Colleges (with 1966-67 enrollment of 171,333 students) and six City University of New York (CUNY) colleges (with 1966-67 enrollment of 103,649 students) that charge little or no tuition or nominal fees only.

[5]Sample consists of most (except California and CUNY) public 4-year colleges with 1966-67 enrollment greater than 2,000 students.

[6]Excludes 75 public 2-year colleges in California (with 1966-67 enrollment of 480,413) students and six public 2-year colleges of the City University of New York System (CUNY) (with 1966-67 enrollment of 30,571 students) that charge little or no tuition or nominal fees only.

[7]Sample consists of most (except California and CUNY) public 2-year colleges with 1966-67 enrollment greater than 1,000 students.

[8]Random sample of private 4-year colleges with 1966-67 enrollment greater than 1,000 students.

[9]Sample consists of most private 2-year colleges with 1966-67 enrollment greater than 200 students.

Table VI-1

Fixed-weight average resident undergraduate student tuition and indexes in institutions of higher education by institutional type and control, fiscal years 1961-1982.

Fiscal year	Public institutions							
	All institutions[1]		Universities		4-year colleges[2]		2-year colleges[3]	
	Amount	Index	Amount	Index	Amount	Index	Amount	Index
1961 ..	$ 219	72.5	$ 282	80.6	$ 175	61.0	$ 167	70.5
1967 ..	302	100.0	350	100.0	287	100.0	237	100.0
1974[1] ..	478	158.3	588	168.0	450	156.8	319	134.6
	459							
1975 ..	489	168.6	621	177.4	488	170.0	337	142.2
1976 ..	523	180.4	642	183.4	531	185.0	379	159.9
1977 ..	546	188.3	661	188.9	549	191.3	411	173.4
1978[1] ..	595	205.2	715	204.3	611	212.9	440	185.7
	578							
1979 ..	618	219.4	781	223.1	634	220.9	475	200.4
1980 ..	658	233.6	840	240.0	645	224.7	529	223.2
1981 ..	706	250.6	911	260.3	712	248.1	541	228.3
1982 ..	755	268.0	973	278.0	791	275.6	551	232.5

Fiscal year	Private institutions							
	All institutions[4]		Universities		4-year colleges[5]		2-year colleges[6]	
	Amount	Index	Amount	Index	Amount	Index	Amount	Index
1961 ..	$ 804	65.3	$ 983	66.0	$ 737	64.3	$ 574	72.1
1967 ..	1,231	100.0	1,489	100.0	1,146	100.0	796	100.0
1974 ..	2,039	165.6	2,393	160.7	1,938	169.1	1,323	166.2
1975 ..	2,170	176.3	2,533	170.1	2,074	181.0	1,377	173.0
1976 ..	2,364	192.0	2,741	184.1	2,267	197.8	1,514	190.2
1977 ..	2,572	208.9	3,025	203.2	2,455	214.2	1,551	194.8
1978 ..	2,784	226.2	3,340	224.3	2,620	228.6	1,709	214.7
1979 ..	3,017	245.1	3,664	246.1	2,811	245.3	1,889	237.3
1980 ..	3,294	267.6	3,893	261.5	3,143	274.3	1,926	242.0
1981 ..	3,721	302.3	4,471	300.3	3,493	304.8	2,318	291.2
1982 ..	4,306	349.8	5,131	344.6	4,074	355.5	2,608	327.6

[1]Tuition values for all public institutions are fixed-weight averages based on the following full-time equivalent student enrollments with the indexes linked for the common year of an enrollment change. For the period 1961-74, FTE enrollment for 1966-67 as follows: universities, 1,476,669 (43.0 percent); 4-year colleges, 1,149,198 (33.4 percent); and 2-year colleges, 812,667 (23.6 percent). For the period 1974-78, FTE enrollment for 1972-73 as follows: universities, 2,066,650 (37.1 percent); 4-year colleges, 1,712,488 (30.8 percent); and 2-year colleges, 1,787,600 (32.1 percent). For the period 1978-82, FTE enrollment for 1978 as follows: universities, 1,773,734 (28.1 percent); 4-year colleges, 2,256,758 (35.7 percent); and 2-year colleges, 2,286,496 (36.2 percent).

[2]Public 4-year colleges with 1966-67 enrollment greater than 2,000 students. California State Colleges and the City University of New York (CUNY) colleges charging nominal tuition "fees" and well-above-average room and board charges (California) are excluded.

[3]Public 2-year colleges with 1966-67 enrollment greater than 1,000 students. Public 2-year colleges in California and in the City University of New York System charging nominal tuition "fees" are excluded.

[4]Values for all private institutions are fixed-weight averages based on full-time equivalent 1966-67 student enrollments as follows: private universities, 543,351 (32.2 percent); private 4-year colleges, 1,019,915 (60.4 percent); and private 2-year colleges, 124,205 (7.4 percent). Only slight shifts in this attendance pattern have occurred. The 1972-73 FTE student enrollment in the private sector was as follows: universities, 564,115 (31.0 percent); 4-year colleges, 1,147,727 (63.1 percent); and 2-year colleges, 105,780 (5.8 percent).

[5]A random sample of private 4-year colleges with 1966-67 enrollment greater than 1,000 students.

[6]Private 2-year colleges with 1966-67 enrollment greater than 200 students.

Tuition Price Trends

Between 1961 and 1982, tuition increases generally have ranged from 6 to 8 percent yearly for U.S. institutions of higher education. The rates of increase have been lower in the public sector than in the private: 2-year colleges, 5.8 percent; universities, 6.1 percent; and 4-year colleges, 7.4 percent. In the private sector, 2-year colleges also had the lowest rate of tuition increase, 7.5 percent, followed by 8.2 percent for private universities and 8.4 percent for private 4-year colleges. The faster growth rate in the private sector means that the ratio of private to public tuition has increased substantially in the last 21 years. The 1982 ratios, and, in parentheses, the 1961 ratios, are as follows: universities, 5.27:1 (3.49:1), 4-year colleges, 5.15:1 (4.21:1); 2-year colleges, 4.73:1 (3.44:1).

In analyzing trends in student tuition, four basic questions should be considered. Has tuition kept pace with inflation so as to maintain institutional purchasing power for this source of revenue? Has tuition income maintained its share of institutional revenues? Does the level of tuition make college education a "better buy" over time compared to other purchases? Are parents more or less able to pay for tuition out of family income? The data in table VI-2 provide answers for these questions.

Columns 1 and 2 of table VI-2 present the dollar amount of tuition and a tuition index for public and private institutions for the 1961-81 period. Dividing the tuition index by the Higher Education Price Index (column 3) reports the relative value of tuition in dollars of constant institutional purchasing power (column 4). In the public sector, tuition revenues per student have maintained a very uniform level of purchasing power for the past 20 years. In the private sector, the substantial growth in tuition has more than offset institutional inflation, resulting in an approximate 37 percent improvement in purchasing power between 1961 and 1981. (1.15/.84 = 1.37).

Table VI-2

Trends in the relationship of student tuition charges to the Higher Education Price Index, institutional educational and general expenditures, the Consumer Price Index, and median family income, fiscal years 1961, 1967, and 1974-1981.

1967 = 100

Fiscal year	Tuition charged		Higher Education Price Index		Educational and general expenditures[1] per FTE student		
	Amount (1)	Index (2)	Index (3)	Tuition HEPI (2)/(3) (4)	Amount (5)	Index (6)	Tuition Exp. (1)/(5) (7)
Public institutions							
1961	$ 219	72.5	77.7	.93	$1,255	77.4	17.5%
1967	302	100.0	100.0	1.00	1,622	100.0	18.6
1974	478[3]	158.3	153.1	1.03	2,553	156.2	18.0
	459						
1975	489	168.6	166.2	1.01	2,615	161.2	18.7
1976	523	180.4	177.2	1.02	2,731	168.4	19.2
1977	546	188.3	188.7	1.00	3,028	186.7	18.0
1978	595[3]	205.2	201.3	1.02	3,301	203.5	17.5
	578						
1979	618	219.4	216.9	1.01	3,655	225.3	16.9
1980	658	233.6	238.3	.98	3,989	245.9	16.5
1981	692	245.7	263.9	.93	4,256	262.4	16.3
Private institutions							
1961	$ 804	65.3	77.7	.84	$1,306	66.5	61.6%
1967	1,231	100.0	100.0	1.00	1,963	100.0	62.7
1974	2,039	165.6	153.1	1.08	3,391	172.7	60.1
1975	2,170	176.3	166.2	1.06	3,429	174.7	63.3
1976	2,364	192.0	177.2	1.08	3,594	183.1	65.8
1977	2,572	208.9	188.7	1.11	3,894	198.4	66.1
1978	2,784	226.2	201.3	1.12	4,124	210.1	67.5
1979	3,017	245.1	216.9	1.13	4,462	227.3	67.6
1980	3,294	267.6	238.3	1.12	4,936	251.5	66.7
1981	3,721	302.3	263.9	1.15	5,391	274.6	69.0

[1]Excludes sponsored research, student financial aid, and mandatory transfers. Data from table III-2.

[2]Source: U.S. Bureau of the Census, *Current Population Reports*, series P-60.

Consumer Price Index		Median family income[2]			
Index (8)	Tuition CPI (2)/(8) (9)	Amount (10)	Index (11)	Tuition Income (1)/(10) (12)	Fiscal year
90.5	.80	$ 5,735	72.3	3.8%	 1961
100.0	1.00	7,933	100.0	3.8	 1967
141.6	1.12	12,902	162.6	3.6	 1974
157.4	1.07	13,719	172.9	3.6	 1975
168.5	1.07	14,958	188.6	3.5	 1976
178.3	1.06	16,009	201.8	3.4	 1977
190.3	1.08	17,640	222.4	3.3	 1978
208.1	1.05	19,661	247.8	3.1	 1979
235.9	.99	21,023	265.0	3.1	 1980
263.1	.93	22,388	282.2	3.1	 1981
90.5	.72	5,735	72.3	14.0%	 1961
100.0	1.00	7,933	100.0	15.5	 1967
141.6	1.17	12,902	162.6	15.8	 1974
157.4	1.12	13,719	172.9	15.8	 1975
168.5	1.14	14,719	188.6	16.1	 1976
178.3	1.17	16,009	201.8	16.1	 1977
190.3	1.19	17,640	222.4	15.8	 1978
208.1	1.18	19,661	247.8	15.3	 1979
235.9	1.13	21,023	265.0	15.7	 1980
263.1	1.15	22,388	282.2	16.6	 1981

[3]Tuition reweighted and series linked in 1974 and 1978 due to enrollment shifts. See footnote 1, table VI-1.

As suggested by the data in column 7, the role of tuition as a source of revenues for education and general expenditures has been increasing at private institutions.[1] Tuition at private institutions now accounts for roughly 69 percent of the revenues directed toward E&G expenditures; in 1961, this percentage was 61.6. In the public sector, the tuition share has declined slightly from the 17.5 percent of 1961 and the 18-19 percent range in the middle 1970's, to 16.3 percent in 1981. Thus, private institutions are relying somewhat more on tuition as a source of revenues, and public institutions slightly less.

Tuition adjusted by the Consumer Price Index reports the degree to which the price of a college education has increased relative to that of other consumer goods. As shown in column 9, a public higher education has remained competitively priced compared to alternative purchases. On the other hand, the price of a private education has increased relative to the cost of other consumer items and therefore is a "poorer buy" in comparison, assuming all goods and services have remained at constant quality.

The cost of a college education relative to the ability to pay as measured by family income is shown in column 12. The average family is better able to afford a public education today than 20 years ago. A private education, on the other hand, now costs 15.7 percent of family income compared to 14 percent in 1961. Still, there has not been much variation in 20 years.

[1]E&G expenditures are used as a base instead of revenues because of the difficulty in identifying revenues from various sources exclusively used for student instruction and relating supporting activities.

VII. ELEMENTARY-SECONDARY SCHOOL CURRENT EXPENSES PRICES AND INDEXES

Current operating expenditures by U.S. public elementary and secondary schools are approaching $100 billion per year. With inflation in the industry at 10 percent, the additional revenues required by public elementary-secondary schools to maintain their purchasing power—or, conversely, their prospective loss in purchasing power—is close to $10 billion per year. Considering that each of the nearly 90,000 schools will feel the impact of inflation, school officials and legislators have a serious responsibility to secure the additional tax revenues these schools require. This process must start with the knowledge of the exact level of inflation affecting the prices of the goods and services purchased by schools.

This chapter presents an indicator that measures the inflation affecting elementary-secondary schools—the Index of Changes in Prices of Goods and Services Purchased by Public Elementary-Secondary Schools for Current Expenses, or, in the interest of brevity, the School Price Index (SPI). The SPI reports the change in the prices paid by schools for a fixed group of inputs, excluding capital investments in plant and equipment, purchased as part of current expenses. The index and its components—professional salaries, nonprofessional salaries, fringe benefits, services, supplies and materials, equipment replacement, library materials and textbooks, utilities, and fixed costs—are presented in table VII-1 and are described in detail beginning on page 136. The sections immediately below illustrate how the SPI can be used in the economic analysis of elementary-secondary school financing trends.

The Effects of Inflation on Current Expenses

Price Trends

From 1975 through 1982, the prices paid by schools for their current operating expenses increased 81.7 percent. Thus, for every $100 spent in 1975 for instruction, administration, libraries, plant operation and maintenance, and other school operations, $181.70 is needed today to buy the same goods and services. The annual rate of inflation has ranged

Table VII-1

Elementary-Secondary School Price Index and major component subindexes, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category as outlined in table VII-3.)

Fiscal year	Personnel compensation			
	Professional salaries (1.0)	Nonprofessional wages and salaries (2.0)	Fringe benefits (3.0)	Total[1]
1975	100.0	100.0	100.0	100.0
1976	107.5	107.4	117.5	108.5
1977	113.2	113.6	136.8	115.8
1978	120.1	121.7	148.8	123.4
1979	128.4	130.7	183.6	134.6
1980	137.0	139.9	209.3	145.1
1981	152.1	154.6	243.2	162.2
1982	165.8	169.9	279.7	178.6

[1]Personnel compensation total index based on weighted average as follows: professional salaries, 72.8 percent; nonprofessional wages and salaries, 16.6 percent; fringe benefits, 10.6 percent.

[2]Contracted services, supplies, and equipment total index based on weighted average as follows: services, 27.15 percent; supplies and materials, 34.79 percent; equipment replace-

from 6.8 percent to 12.2 percent, with a compound annual rate of increase of 8.88 percent.

Although the period for which the School Price Index has been computed (1975 through 1982) is short, it nevertheless provides some understanding of the relationship between inflation in the economy as a whole and inflation in elementary-secondary education. During this 7-year period, the CPI and SPI paralleled each other, as shown in figure VII-1, both increasing a total of 8[illegible].7 percent. Schools achieved this inflation rate by holding salaries substantially below the CPI, increasing them only in the 65 to 70 percent range. This offsets the high 94 percent increase in contracted services, supplies, and equipment and the exceptionally high 179.7 percent increase in fringe benefits. Teacher and other professional salaries in dollars of constant purchasing power were roughly 8 percent less in 1982 than in 1975. However, if inflation continues to decline and if teacher salaries are increased at the current rate of 9 percent a year, some lost ground should be recovered.

Contracted services, supplies, and equipment								Annual percent increase over previous year
Services (4.0)	Supplies and materials (5.0)	Equipment replacement (6.0)	Library materials and textbooks (7.0)	Utilities (8.0)	Fixed costs (9.0)	Total[2]	School Price Index[3]	
100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
106.9	107.8	109.6	112.6	111.1	112.8	109.1	108.6	8.6
113.8	112.8	115.9	116.4	123.3	127.5	117.0	116.0	6.8
121.4	119.4	124.3	123.7	134.7	142.4	125.9	123.9	6.8
127.9	130.8	134.5	131.5	156.4	159.9	136.0	135.3	9.2
138.5	148.1	148.1	137.8	203.9	178.6	157.0	147.5	9.0
153.3	165.2	163.8	147.8	258.3	200.3	178.7	165.5	12.2
169.2	175.2	177.7	160.1	284.6	218.0	194.0	181.7	9.8

ment, 3.38 percent; books, periodicals, and audiovisual, 6.13 percent; utilities, 13.51 percent; fixed costs, 15.06 percent.

[3]School Price Index based on weighted average as follows: personnel compensation, 79.75 percent; contracted services, supplies, and equipment, 20.25 percent. All weight data from table VII-3.

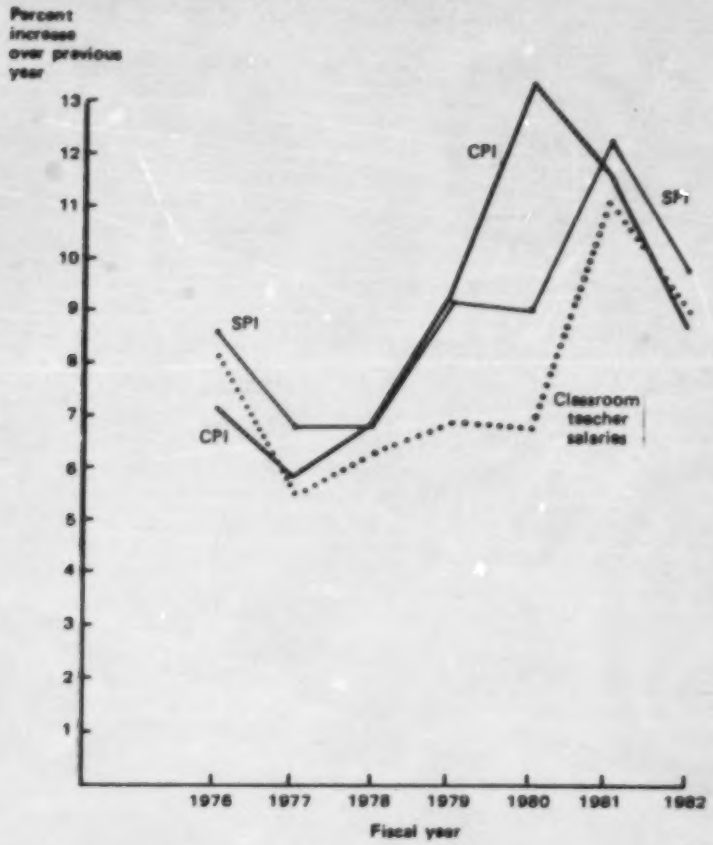
Price Trends Within Current Expenses

Price trends within the SPI are presented in table VII-1 and illustrated in figure VII-2. As shown, six of the nine SPI components sustained *less* inflation than the overall SPI rate—professional salaries, nonprofessional salaries, services, supplies and materials, equipment replacement, and library materials and textbooks. However, the three other SPI components—fringe benefits, utilities, and fixed costs—had exceptionally high inflationary rates. Thus, although these three components account for only 14.23 percent of expenditures, their inflation rates were sufficiently high to raise the overall SPI above all the other components (see figure VII-2).

Within the utilities component, natural gas has been the most inflationary item, with an over-sixfold increase in price since 1975. The price of fuel oil more than tripled during the same period. Of the fixed cost items, the price of insurance doubled between 1975 and 1982, while local school payments for fringe benefits almost tripled.

Figure VII-1

Yearly percent changes or inflation rate in the School Price Index, classroom teacher salaries, and the Consumer Price Index, 1976-1982.

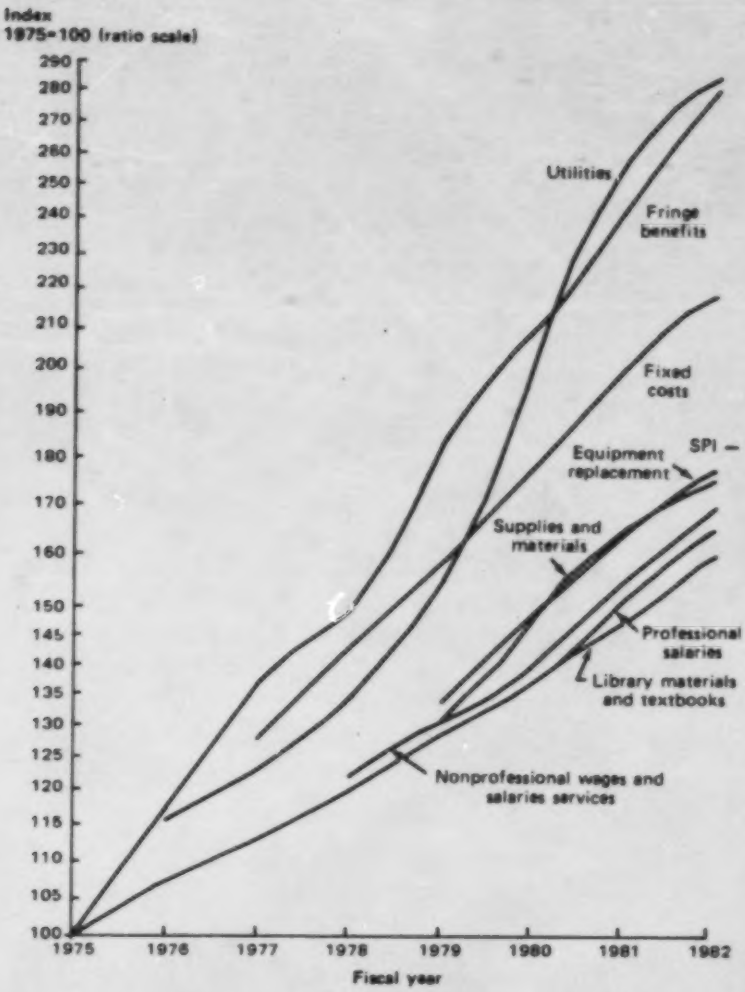


Deflation of Expenditures

The impact of inflation on elementary-secondary school expenditures for 1975-81 is shown in table VII-2 and figure VII-3. The 6-year growth in public school expenditures for current expenses was 62.4 percent. This increase, in its entirety, was necessary to offset industry inflation during the period of 65.5 percent. Had enrollment during the period remained

Figure VII-2

Comparison of trends in price change in major component subindexes of the School Price Index, fiscal years 1975-1982.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

Table VII-2

Current expenditures in public elementary-secondary schools, amount and amount per average daily attendance pupil in actual and constant dollars, fiscal years 1975-1981.

Fiscal year	Public enrollment K-12 average daily attendance	Expenditure amount		Expenditures per ADA pupil		
		Actual dollars (000)	Constant dollars[1] (000)	Actual dollars	Constant dollars[1]	Constant dollar 1981 prices
1975	41,524,000	$56,680,670	$56,680,670	$1,365	$1,365	$2,260
1976	41,274,000	62,054,105	57,140,059	1,503	1,384	2,291
1977	40,832,000	66,864,475	57,641,788	1,638	1,412	2,337
1978	40,079,000	73,068,023	58,965,313	1,823	1,471	2,434
1979	39,076,000	78,951,240	58,352,727	2,020	1,493	2,469
1980	38,289,000	86,984,142	58,972,299	2,272	1,540	2,550
1981	37,697,000[2]	92,009,000[2]	55,594,562	2,441	1,475	2,441

[1]Constant dollars in 1975 prices.

[2]Preliminary.

Source: U.S. Department of Education, National Center for Education Statistics.

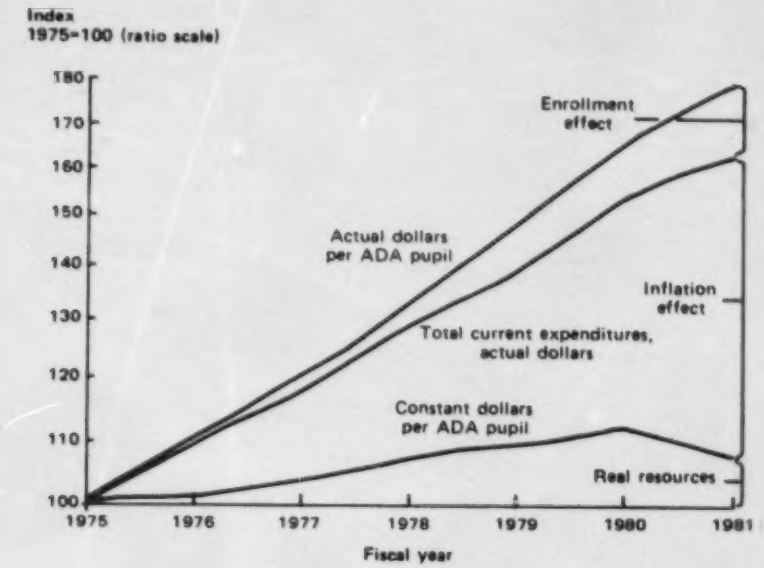
level, there would have been a slight decline in constant dollar expenditures per pupil. However, the expected nearly 10 percent drop in attendance at public schools during the 6 years greatly aided financing. In dollars of constant purchasing power, expenditures per student increased 8 percent, with the 1981 expenditures of $2,441 per pupil equating to $2,260 spent in 1975. The $181 per pupil increase in real expenditures in 1981 dollars means that, overall, public schools spent $6.8 billion more relative to their pupil load in 1981 than they spent in equivalent 1981 dollars 6 years ago.

Description of Index and Data Base

The School Price Index is concerned with price changes in the salaries of teachers, principals, and other professional personnel, nonprofessional salaries and wages, fringe benefits, supplies and materials, equipment replacement, books and periodicals, utilities, and fixed costs—in essence, the goods and services purchased by elementary-secondary schools for their current operations. Expenditures for capital outlay and

Figure VII-3

Trends in current expenditures in public elementary-secondary schools, amount and amount per pupil in actual and constant dollars, fiscal years 1975-1981.



Note: The vertical axis is expressed on a ratio or logarithmic scale; i.e., equal vertical distances reflect equal proportional (as distinguished from absolute) changes.

debt service are excluded.[1] The various items priced by the SPI and their relative weight (i.e., proportion of the total current expenses budget) are presented in table VII-3.

The SPI is a weighted aggregative index number with "fixed," or "constant," weights, often referred to as a "market basket" index. The SPI measures price change by repricing each year and comparing the aggregate costs of the goods and services bought by schools in a selected base period. The quantities of goods and services are kept constant based on the 1974-75 buying pattern of elementary-secondary schools. The quantities represent not only annual consumption of the specific sample items actually priced by the index, but also consumption of related items

[1]Capital outlays are expenditures that result in the acquisition of fixed assets or in additions to fixed assets that are presumed to have benefits for more than 1 year, such as expenditures for land or existing buildings, improvements of grounds, construction of buildings, or initial, additional, and replacement of equipment.

Table VII-3

Elementary-secondary school current expenditures by object category, fiscal years 1974, 1976, and 1974-76 average.

Category	1973-74 Amount (in thousands)	Percent
Personnel compensation	40,697,229	80.62
1.0 Professional salaries	29,862,641	59.20
1.1 Superintendents and other administrative and professional staff	882,702	1.77
1.2 Principals	1,697,873	3.36
1.3 Supervisors of instruction	659,586	1.31
1.4 Classroom teachers	24,517,483	48.57
1.5 Librarians	516,032	1.02
1.6 Guidance, counseling, psychology, and attendance personnel	1,327,036	2.63
1.7 Health personnel	271,929	.54
2.0 Nonprofessional wages and salaries	6,538,325	12.96
2.1 Teacher aides and paraprofessionals	683,723	1.35
2.2 Secretarial and clerical personnel	1,866,279	3.70
2.3 Custodians	2,104,273	4.17
2.4 Maintenance trade personnel	528,533	1.05
2.5 Food service personnel	663,656	1.31
2.6 Bus drivers	691,862	1.37
3.0 Fringe benefits	4,276,263	8.47
Contracted services, supplies, and equipment	9,780,587	19.38
4.0 Services	2,554,439	5.06
4.1 Plant operation and maintenance	514,752	1.02
4.2 Travel	165,154	.33
4.3 Printing and duplication	286,843	.57
4.4 Communication	419,237	.83
4.5 Contracted student transportation	769,270	1.52
4.6 Data processing	190,562	.38
4.7 Consultants	127,041	.25
4.8 Teacher education	82,577	.16
5.0 Supplies and materials	3,555,736	7.04
5.1 Instructional	987,457	1.96
5.2 Administrative and secretarial	627,261	1.24
5.3 Plant operation	244,174	.48
5.4 Student transportation	289,870	.57
5.5 Health	44,560	.09
5.6 Food	811,133	1.61
5.7 Food services	191,062	.38
5.8 Plant maintenance	360,229	.71

1975-76		1974-75 Est. (Based on average 1973-74 and 1975-76)	
Amount (in thousands)	Percent	Amount (in thousands)	Percent
49,505,770	79.02	45,101,496	79.75
35,798,176	57.15	32,840,407	58.07
1,279,259	2.05	1,085,980	1.92
2,070,142	3.30	1,884,007	3.33
678,658	1.08	669,122	1.18
29,419,311	46.97	26,968,397	47.68
667,000	1.06	591,516	1.05
1,363,157	2.18	1,345,096	2.38
320,649	.51	296,289	.53
8,437,709	13.46	7,488,015	13.24
1,029,566	1.64	856,644	1.51
2,093,096	3.34	1,979,687	3.50
2,469,631	3.94	2,286,952	4.04
960,412	1.53	744,472	1.32
937,343	1.50	800,499	1.42
947,661	1.51	819,761	1.45
5,269,885	8.41	4,773,074	8.44
13,130,388	20.98	11,466,522	20.25
3,666,217	5.86	3,110,325	5.50
600,127	.96	557,439	.98
284,150	.45	224,652	.40
491,798	.79	388,820	.69
721,304	1.15	570,270	1.01
880,320	1.41	824,796	1.46
327,866	.52	259,214	.46
218,577	.35	172,809	.31
142,075	.23	112,326	.20
4,415,225	7.05	3,985,519	7.04
1,006,807	1.61	997,132	1.76
895,857	1.43	761,599	1.35
335,778	.54	289,976	.51
405,094	.65	347,482	.61
59,147	.09	51,863	.09
1,145,641	1.83	978,387	1.73
269,841	.43	230,466	.41
297,060	.47	328,644	.58

Table VII-3 (Cont)

Elementary-secondary school current expenditures by object category, fiscal years 1974, 1976, and 1974-76 average.

Category	1973-74 Amount (in thousands)	Percent
6.0 Equipment replacement	373,337	.74
6.1 Replacement of student transportation vehicles	122,637	.24
6.2 Replacement of plant equipment	250,700	.50
7.0 Library materials and textbooks	625,247	1.24
7.1 Library materials	269,891	.54
7.2 Free textbooks to students	355,356	.70
8.0 Utilities	1,300,992	2.58
8.1 Fuel oil	503,610	1.00
8.2 Electrical power	629,932	1.25
8.3 Natural gas	23,921	.05
8.4 Water and sewerage	79,738	.15
8.5 Trash collection	63,791	.13
9.0 Fixed costs	1,370,839	2.72
9.1 Insurance	1,055,746	2.09
9.2 Rents	56,267	.11
9.3 Other	258,826	.52
TOTAL	50,477,796	100.0

Source: National Center for Education Statistics, *Statistics of State School Systems 1973-74 and 1975-76.*

for which prices are not obtained, so that the total cost of the market basket represents total institutional spending for all goods and services.

The index is calculated on the reference base of fiscal year 1975 = 100. This means that current prices are expressed as a percentage of prices for 1975. An index of 110 means that prices have increased 10 percent since the base period; an index of 90 indicates a 10 percent decrease. The index can be converted to any desired base period by dividing each index number to be converted by the index for the desired base period.

Index Weighting Structure

The composition of expenditures for current operations by object classification used for computing the School Price Index is shown in

1975-76		1974-75 Est. (Based on average 1973-74 and 1975-76)	
Amount (in thousands)	Percent	Amount (in thousands)	Percent
398,196	.63	384,766	.68
162,370	.26	142,503	.25
233,826	.37	242,263	.43
779,844	1.25	702,545	1.24
345,438	.55	307,664	.54
434,406	.70	394,881	.70
1,794,374	2.87	1,547,682	2.74
1,025,357	1.64	764,483	1.35
607,523	.97	618,727	1.10
23,071	.04	23,496	.04
76,902	.12	78,320	.14
61,521	.10	62,656	.11
2,078,532	3.32	1,724,686	3.05
1,566,042	2.50	1,310,894	2.32
176,441	.28	116,364	.21
336,049	.54	297,437	.52
62,636,158	100.0	56,557,018	100.0

table VII-3. The source of the data is the National Center for Education Statistics.[2]

To minimize the consequences of reporting errors and minor year-to-year fluctuations, the SPI base year composition (1974-75) has been calculated as a 2-year average (1973-74 and 1975-76) rather than depending exclusively on the data for a single year.

[2]The data are based on NCES surveys of all elementary-secondary schools for 1974-75 and 1975-76, the last years in which NCES collected expenditures by *object* classification. This massive, detailed collection effort presents an exceptional opportunity to establish a valid object base for the School Price Index.

Currently, the Educational Research Service is the only organization collecting expenditure data by object classification. ERS provides a Local School Budget Analysis Service that allows school systems to compare their budgets by basic functional categories and key object categories with other school systems with comparable enrollments and per pupil expenditures. The ERS data, published as the *Comparative Analysis*, allow comparisons for both revenues and expenditures on a per pupil and percent of total basis.

Personnel compensation represented 79.75 percent of current operations expenditures for U.S. elementary-secondary schools in 1974-75. The largest expenditures for personnel compensation were for teachers (47.68 percent), fringe benefits (8.44 percent), custodial workers (4.04 percent), and secretaries and clerical (3.50 percent). Contracted services, supplies, and equipment, which accounted for 20.25 percent of the total current operations budget, consisted of services (5.50 percent), supplies and materials (7.04 percent), equipment replacement (0.68 percent), library (1.24 percent), and utilities (2.74 percent). Fixed costs for insurance and for rent and leases equaled 3.05 percent of the budget.

The expenditure patterns of individual institutions may differ markedly from these national averages. However, such variations have no substantial effect on the applicability of the SPI to any given institutional situation. Modest differences in the weights attached to expenditure categories have little effect on overall index values because the SPI is dominated by the trend in teacher salaries and because the salary trends for other personnel hired by schools are similar.

A fixed weight index such as the SPI occasionally requires revision of the weights assigned to various items if it is to reflect accurately current goods and services being purchased. Such revision should be relatively infrequent since even small changes in the composition or quality of the goods and services being purchased prevent unambiguous comparisons of price *alone* without intangible considerations. A budget change should be made only when it reflects a change in the actual *physical count* relationships of items, not simply the effect of price change on budget proportions. New weights, when necessary, may be introduced periodically by a process of "linking" (see pp. 26-31) without affecting the index level.

Selection of Salary Data

Three sources provide salary data on elementary-secondary school personnel: the Bureau of the Census, the National Education Association (NEA), and the Educational Research Service, Inc. (ERS). Only ERS provides salary detailed by type of position required for index compilation. Therefore, ERS data—salaries for 19 professional positions and 10 nonprofessional positions—have been used exclusively.

It is interesting to compare data from the three sources, as is done below for 1975 through 1982. The Bureau of the Census reports the average October payroll for instructional staff based on an annual sample. NEA reports average yearly salaries for instructional staff and classroom teachers based on reports by state departments of education. ERS collects data from a stratified sample of schools and reports average salaries based on equal weight given to each school reporting.

Comparison of school salary data from three sources

Classroom teacher average salaries

School year	National Education Association			Educational Research Service		
	Annual amount	Index	Percent change	Annual amount	Index	Percent change
1974-75	$11,690	100.0	—	$11,507	100.0	—
1975-76	12,591	107.7	7.7	12,437	108.1	8.1
1976-77	13,352	114.2	6.0	13,119	114.0	5.5
1977-78	14,207	121.5	6.4	13,941	121.1	6.3
1978-79	15,022	128.5	5.8	14,899	129.5	6.9
1979-80	15,951	136.4	6.1	15,913	138.3	6.8
1980-81	17,597	150.5	10.3	17,678	153.6	11.1
1981-82	19,142	163.7	8.8	19,275	167.5	9.0

Instructional staff average salaries[1]

School year	National Education Association			Bureau of the Census			Educational Research Service	
	Annual amount	Index	Percent change	October amount	Index	Percent change	Index[2]	Percent change
1974-75	$12,167	100.0	—	$1,028	100.0	—	100.0	—
1975-76	13,120	107.8	7.8	1,090	106.0	6.0	107.5	7.5
1976-77	13,840	113.8	5.5	1,157	112.5	6.1	113.2	5.3
1977-78	14,697	120.8	6.2	1,221	118.8	5.5	120.1	6.1
1978-79	15,762	129.5	7.2	1,297	126.2	6.2	128.4	6.9
1979-80	16,773	137.9	6.5	1,389	135.1	7.1	136.9	6.6
1980-81	18,395	151.2	9.6	1,513	147.2	8.9	152.0	11.0
1981-82	20,114	165.3	9.3	1,628	158.4	7.6	165.7	9.0

[1]Instructional staff generally includes classroom teachers, principals, supervisors, librarians, guidance counselors, and psychological personnel.

[2]ERS salary data for professional personnel (superintendents and administrators, principals, supervisors of instruction, classroom teachers, librarians, counselors, and health personnel) are weighted by the School Price Index weighting system. See table VII-4.

The three agencies, Census, NEA, and ERS have different objectives, different collection and control procedures, and different reporting sources. In particular, data differences arise from variations in sampling procedures and in extrapolation of averages, in school versus department reporting units, and in definitions and reporting periods. Review of the procedures used by the three agencies provides no evidence that greater

confidence can be placed in one source or the other. Given this situation, the ERS salary data were selected as the most comprehensive and because of their greater reliability for continued reporting.[3]

Certain problems arise in using the ERS salary data for price index purposes, as would be the case in using any secondary data not designed specifically for price index purposes. First, the ERS sample of schools from small and very small enrollment strata varies from year-to-year as in most surveys of this type. A pure price index series requires maintenance of the same reporting units. Second, in providing comparable data by school systems of similar enrollment size, expenditure level, and geographic region, ERS reports a mean of the average salaries paid, with equal weight given to each school system regardless of the number of employees involved. ERS cautions that: "No attempt has been made to weight the stratified data to estimate national statistics such as the national average salary of teachers...." A true average salary based on the aggregate number of all employees is required for price index compilation. Third, ERS, and NEA as well, does not provide a fix weighted series for classroom teachers; that is, the proportion of teachers at various levels within the school system is not held constant but varies from year to year, introducing changes in the computed average salary level resulting from possible changes in teacher mix.

Despite these shortcomings, the consistency of the ERS collection and verification procedures suggests that the resulting salary price trends (as distinguished from absolute levels) are reasonable approximations to what would be obtained had more exacting price index procedures been employed. The school systems sampled by ERS account for approximately 3.8 million persons, or approximately 99 percent of all those employed in the public schools of the nation.

Index Prices and Data Sources

The items priced by the SPI include the most important services and goods purchased by elementary-secondary schools for current operations, and a sample of the less important ones. In combination, they represent all items purchased.

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[3]The salary data used in this study are from the ERS publication *National Survey of Salaries and Wages in Public Schools, Part 2, Salaries Paid Professional Personnel in Public Schools,* and *Part 3, Wages and Salaries Paid Support Personnel in Public Schools.* In addition, ERS publishes *Measuring Changes in Salaries and Wages in Public Schools: A Basic Handbook,* which presents yearly and extended period percent changes in average salaries and wages for individual positions and position categories, and a composite indicator of change (CIC). These data are also organized by enrollment grouping. Overall, the data are exceptionally useful for comparing salary trends among various categories of personnel, among comparable school systems, and with economic indicators such as the Consumer Price Index.

This section describes the items priced for the index and data sources. It should be kept in mind that the essential objective in pricing is to maintain constant quality in the item being observed or exclude those differences in price attributable to changes in product service or quality.

PERSONNEL COMPENSATION

1.0 Professional salaries

Subindexes for salaries of the various professional personnel categories are shown in table VII-4. The weights are based on national data collected by NCES as reported in table VII-3. All professional salary data are from the *National Survey of Salaries and Wages in Public Schools, Part 2, Salaries Paid Professional Personnel in Public Schools,* published annually by ERS. The weights assigned various positions *within* the subcategories, reported in footnote 2 to tables VII-5 and VII-6, are estimated budget proportions derived from Educational Research Service data for 1979-80 on the total number of persons employed in each type of professional position and their respective salaries.

1.1 Superintendents and other administrative and professional staff

Detailed information for the subindex for superintendents and other administrative and professional staff is reported in table VII-5. This subindex consists of the weighted average of salaries for superintendents, for deputy/associate superintendents, for assistant superintendents, and for the directors, managers, coordinators, and supervisors for finance and business, public relations/information, instructional services, staff personnel services, and electronic data processing.

No data are available on the salaries paid to electronic data processing personnel by elementary-secondary schools. As a proxy, nationwide annual salaries of EDP employees as surveyed and reported by the periodical *Infosystems* have been used. In 1980, the survey reflected the salaries of EDP employees in over 1,200 installations in major metropolitan areas. A fixed-weight composite average weekly salary was calculated for 20 EDP job classifications consistently reported since 1975. The jobs include managers and supervisors, computer systems analysts, programmers, computer operators, and keypunch and tape operators.

1.2 Principals

Detailed information on the subindex for principals is reported in table VII-6. The subindex consists of the weighted average of salaries for principals and assistant principals for elementary schools, junior high/middle schools, and senior high schools.

Table VII-4

Indexes and salaries of professional personnel used for the School Price Index, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category as outlined in table VII-3.)

Fiscal year	Superintendent and other administrators[1] (1.1) Index	Principals[2] (1.2) Index	Supervisors of instruction (1.3) Salary	Supervisors of instruction (1.3) Index	Classroom teachers (1.4) Salary	Classroom teachers (1.4) Index
1975	100.0	100.0	$18,601	100.0	$11,507	100.0
1976	105.8	103.9	19,694	105.9	12,437	108.1
1977	110.1	108.9	20,266	109.0	13,119	114.0
1978	116.0	115.3	21,318	114.6	13,941	121.1
1979	123.9	123.1	23,038	123.9	14,899	129.5
1980	131.3	131.0	23,962	128.8	15,913	138.3
1981	144.9	145.0	26,640	143.2	17,678	153.6
1982	156.6	157.0	29,083	156.4	19,275	167.5

[1]For salary detail, see table VII-5.

[2]For salary detail, see table VII-6.

[3]Professional salaries total index based on weighted average as follows: superintendent and other administrators, 3.3 percent; principals, 5.7 percent; supervisors of instruction,

1.3 Supervisors of instruction; 1.4 Classroom teachers; 1.5 Librarians; 1.6 Guidance counseling, psychology, and attendance personnel; and *1.7 Health personnel*

The salary and indexes for these subcomponents are reported in table VII-4. The salary data are for the following ERS position categories, respectively: subject area supervisors, classroom teachers, librarians, counselors, and school nurses.

2.0 Nonprofessional wages and salaries

Subindexes for salaries of the various nonprofessional personnel categories are shown in table VII-7. The weights are based on national data collectd by NCES as reported in table VII-3. Salary data for all nonprofessional wages and salaries (except for category 2.4, maintenance trade personnel) are from the *National Survey of Salaries and Wages in Public Schools, Part 3, Wages and Salaries Paid Support Personnel in Public Schools,* published annually by ERS. The weights assigned various positions *within* the subcategories, reported in footnote 1 to tables VII-8 and VII-9, are estimated budget proportions derived from

Librarians (1.5)		Guidance counselors (1.6)		Health personnel (1.7)		Professional salaries Total[3] (1.0)	Fiscal year
Salary	Index	Salary	Index	Salary	Index	Index	
$12,546	100.0	$14,479	100.0	$10,673	100.0	100.0	1975
13,207	105.3	15,017	103.7	11,046	103.5	107.5	1976
13,921	110.0	15,883	109.7	11,729	109.9	113.2	1977
14,739	117.5	16,641	114.9	12,357	115.8	120.1	1978
15,727	125.4	17,698	122.2	13,113	122.9	128.4	1979
16,764	133.6	18,847	130.2	13,788	129.2	137.0	1980
18,689	149.0	21,003	145.1	15,355	143.9	152.1	1981
20,496	163.4	22,935	158.4	16,704	156.5	165.8	1982

2.1 percent; classroom teachers, 82.1 percent; librarians, 1.8 percent; guidance counselors, 4.1 percent; and health personnel, 0.9 percent. Based on table VII-3. [3]Weights based on NCES data.

Source: Educational Research Service, Inc., *Salaries Paid Professional Personnel in Public Schools,* volumes covering 1975-1982.

ERS data for 1970-80 on the total number of persons employed in each type of nonprofessional position and their respective salaries.

2.1 Teacher aids and paraprofessional

The hourly wage rates and indexes for instructional and noninstructional teacher aides and paraprofessionals are reported in table VII-8.

2.2 Secretaries and clerical personnel

The hourly wage rates and indexes for the various types of secretaries and clerical personnel at the central office and at the school building level are reported in table VII-9.

2.3 Custodians; 2.5 Food service personnel; and *2.6 Bus drivers*

The salary and indexes for these subcomponents are reported in table VII-7. The salary data are for the following ERS position categories, respectively: custodians (not engineers), cafeteria workers (not supervisors), and school bus drivers.

Table VII-5

Indexes and salaries[1] for superintendents and other administrative and professional staff of public primary and secondary schools, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category as outlined in table VII-3.)

Fiscal year	Superintendents		Superintendents Associate superintendents		Assistant superintendents	
	Amount	Index	Amount	Index	Amount	Index
1975	$30,338	100.0	$30,074	100.0	$26,460	100.0
1976	32,527	107.2	30,778	102.3	27,082	102.4
1977	33,233	109.5	31,799	105.7	28,099	106.2
1978	34,875	115.0	33,391	110.0	29,719	112.3
1979	36,924	121.7	34,898	116.0	31,513	119.1
1980	39,344	129.7	37,440	124.5	33,452	126.4
1981	43,001	141.7	41,117	136.7	36,633	138.4
1982	46,664	153.8	44,777	148.9	39,799	150.4

[1]Average salary for full-time superintendents and other administrators based on 12-month year.

[2]Weighted average based on the proportion of total superintendent and other administrators' salaries paid as follows: superintendents, 13.2 percent; associate superintendents, 6.3 percent; assistant superintendents, 19.5 percent; finance and business personnel, 12.0 percent; public relations personnel, 3.1 percent; instructional personnel, 24.5 percent; personnel, 10.7 percent; and EDP personnel, 10.7 percent. Weights based on ERS data.

Source: Educational Research Service, Inc., *Salaries Paid Professional Personnel in Public Schools*, volumes covering 1975-1982.

2.4 Maintenance trade personnel

For this category, the Bureau of Labor Statistics' (BLS) Employment Cost Index (ECI) for craft and kindred workers has been used since 1977. Prior to 1977, and linked to the later series, is a fixed weight composite of average weekly earnings for eight skilled maintenance and toolroom occupations collected by the BLS, *Area Wage Survey*. The index values are reported in table VII-7.

3.0 Fringe benefits

Fringe benefits consist of expenditures by schools for various services to employees. The principal benefits and their usual order of importance are: retirement contributions, social security, health insurance, life insurance, employment compensation, workmen's compensation, and income continuation insurance. Usually, vacation and sick leave are also

Other Administrators							
Finance and business		Public relations		Instructional		Personnel	
Amount	Index	Amount	Index	Amount	Index	Amount	Index
$19,743	100.0	$18,553	100.0	$21,330	100.0	$21,116	100.0
21,436	108.6	19,519	105.2	22,830	107.0	22,239	105.3
22,380	113.4	20,308	109.5	23,874	111.9	23,523	111.4
23,358	118.3	21,412	115.4	25,268	118.5	24,434	115.7
24,507	124.1	22,207	119.7	27,034	126.7	26,857	127.2
25,610	129.7	23,479	126.6	28,554	133.9	28,070	132.9
28,672	145.2	25,854	139.4	31,707	148.6	30,821	146.0
30,884	156.4	28,042	151.1	34,345	161.0	33,331	157.8

Electronic data processing personnel Index	Superintendents and other administrators total index[2] (1.1) Index	Fiscal year
100.0	100.0	1975
107.4	105.8	1976
111.2	110.1	1977
119.4	116.0	1978
131.5	123.9	1979
142.1	131.3	1980
157.2	144.9	1981
166.0	156.6	1982

considered to be fringe benefits, but because they do not involve a dollar outlay they are not part of the fringe benefit expenditure package reported here.

In the context of a price index, fringe benefits are regarded as a package preinvestment of earnings that, together with salary, constitute the total across-the-board compensation schools must pay to attract and hold competent staff. Thus, the price series for fringe benefits does *not*

Table VII-6

Indexes and salaries[1] for principals and assistant principals of public primary and secondary schools, fiscal years 1975-1982.

1975 = 100 **(Number code in parentheses identifies category as outlined in table VII-3.)**

Fiscal year	Principals					
	Elementary school		Junior high/ middle school		Senior high school	
	Amount	Index	Amount	Index	Amount	Index
1975	$19,061	100.0	$21,136	100.0	$22,894	100.0
1976	19,865	104.2	21,876	103.5	23,306	101.8
1977	20,816	109.2	22,961	108.6	24,225	105.8
1978	22,132	116.1	24,235	114.7	25,642	112.0
1979	23,618	123.9	25,910	122.6	27,422	119.8
1980	25,165	132.0	27,625	130.1	29,207	127.6
1981	27,923	146.5	30,401	143.8	32,231	140.8
1982	30,242	158.7	32,881	155.6	34,776	151.9

[1]Average salary for supervisory and assistant principals based on 12-month year.

[2]Weighted average based on the proportion of total supervisory and assistant principals paid as follows: elementary school supervisory principals, 41.9 percent; junior high supervisory principals, 11.0 percent; senior high supervisory principals, 10.4 percent; elementary

price a fixed package of benefits whose form and quality are kept constant. Rather, the price series represents, as it does for salaries, the benefits that schools must give teachers and staff to remain competitive in the labor market.

No single organization currently collects data on the total dollar value of fringe benefits. The Education Research Service, in its *National Survey of Fringe Benefits in Public Schools,* presents detailed descriptive information on the types of benefits received by superintendents, administrators, and teachers. The Assembly of Governmental Employees reports similar information in *A Study of State Government Employee Benefits.* In both instances, the information is mostly descriptive—the numbers of schools (states) providing various types of benefits and, in some instances, an associated dollar value or the percentage of salary involved. In the absence of complete data on the dollar value of fringe benefits for elementary-secondary school personnel, a proxy price series has been derived using the relationship between fringe benefits and salaries in public higher education.

Assistant Principals						Supervisory and assistant principals total index[2] (1.2)
Elementary school		Junior high/ middle school		Senior high school		
Amount	Index	Amount	Index	Amount	Index	
$15,988	100.0	$17,868	100.0	$18,939	100.0	100.0
16,875	105.7	18,609	104.1	19,651	103.8	103.9
17,561	110.0	19,617	109.8	20,714	109.4	108.9
18,778	117.6	20,682	115.7	21,680	114.5	115.3
19,827	124.2	22,171	124.1	23,222	122.6	123.1
20,708	129.7	23,507	131.6	24,816	131.0	131.0
23,118	144.8	26,045	145.8	27,285	144.1	145.0
25,331	158.6	28,176	157.7	29,586	156.1	157.0

school assistant principals, 6.9 percent; junior high assistant principals, 10.9 percent; and senior high assistant principals, 18.9 percent.

Source: Educational Research Services, Inc., *Salaries Paid Professional Personnel in Public Schools*, volumes covering 1975-1982.

As shown in table VII-10, column (3), fringe benefits for faculty at public colleges and universities have grown relatively consistently with faculty salaries. During a smooth curve for this ratio [column (4)] establishes a trend that is assumed to be characteristic for state and local government employees in general and for public school teachers in particular. With slight adjustment for the absolute level of school versus college benefits, the smooth curve ratios are applied to classroom teacher salaries to derive estimated teacher fringe benefits [column (6)]. The price series for teachers is assumed to apply to all school personnel. Although this proxy for school fringe benefits is based on a reasonable assumption of common behavior and use of relevant similar data, it is only an *estimate* and should not be used outside the context of this price index compilation.

CONTRACTED SERVICES, SUPPLIES, AND EQUIPMENT

Services, supplies, and equipment constituted 17.21 percent of the current expenses budget of elementary-secondary schools during the base

Table VII-7

Indexes and salaries of nonprofessional personnel used for the School Price Index, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category as outlined in table VII-3.)

Fiscal year	Teacher aides and paraprofessionals[1] (2.1)	Secretaries and clerical personnel[2] (2.2)	Custodians (2.3)	
	Index	Index	Hourly rate	Index
1975	100.0	100.0	$3.54	100.0
1976	106.2	107.7	3.78	106.8
1977	112.0	113.6	3.99	112.7
1978	120.1	121.3	4.25	120.1
1979	128.8	128.8	4.53	130.0
1980	139.2	138.2	4.88	137.9
1981	153.6	154.7	5.35	151.1
1982	167.6	170.1	5.95	168.1

[1]For salary detail, see table VII-8.

[2]For salary detail, see table VII-9.

[3]Data gathered from Employment Cost Index do not include salary amounts.

[4]Nonprofessional personnel index based on weighted average as follows: teacher aides and paraprofessionals, 11.5 percent; secretaries and clerical personnel, 26.4 percent;

period 1974-75. The division of these expenditures, shown in table VII-3, is as follows: services, 5.50 percent; supplies and materials, 7.04 percent; equipment replacement, 0.68 percent; library, 1.24 percent; and utilities, 2.74 percent.

The services, supplies, and equipment used by elementary-secondary schools are produced and sold by a range of industries. Some purchases are of relatively commonplace items (office supplies and equipment, postage, telephone, utilities, and transportation) typical of the operation of many organizations and commercial businesses. Other purchases involve specialized items necessary for instruction, such as scientific instruments and measuring devices, chemicals, laboratory glassware, sports equipment, and books and periodicals. Because of the number, diversity, and specialty of these items, any grouping of similar commodities for pricing purposes necessarily will involve approximate weightings and representative pricing.

Maintenance trade personnel[3] (2.4)	Food service personnel (2.5)		Bus drivers (2.6)		Nonprofessional personnel total Index[4] (2.0)
Index	Hourly rate	Index	Hourly rate	Index	
100.0 est.	$2.61	100.0	$3.75	100.0	100.0
108.2 est.	2.83	108.4	4.04	107.7	107.4
116.5	3.00	114.9	4.28	114.1	113.6
125.7	3.24	124.1	4.59	122.4	121.7
136.4	3.48	133.3	4.93	131.5	130.7
147.5	3.78	144.8	5.21	138.9	139.9
161.7	4.17	159.8	5.75	153.3	154.6
175.6	4.57	175.1	6.26	166.9	169.9

custodians, 30.5 percent; maintenance trade personnel, 9.9 percent; food service personnel, 10.7 percent; and bus drivers, 11.0 percent. Based on table VII-3.

Source: Educational Research Service, Inc., *Salaries Paid Support Personnel in Public Schools*, volumes covering 1975-1982.

4.0 Services

The price indexes for contracted services are presented in table VII-11. Contracted services are organized into eight subcomponents: plant operation and maintenance, 17.9 percent; travel, 7.2 percent; printing and duplication, 12.5 percent; communication, 18.3 percent; contracted student transportation, 26.5 percent; data processing, 8.4 percent; consultants, 5.6 percent; and teacher education, 3.6 percent.

4.1 Plant operation and maintenance

Contracted services for plant operation and maintenance usually encompass cleaning, snow removal, road and grounds maintenance, and other work often requiring special equipment not normally owned by school systems. These services involve workers performing a variety of duties at a semiskilled level. The price series used is wages for nonfarm

Table VII-8

Indexes and hourly rate for teacher aides and paraprofessionals of public primary and secondary schools, fiscal years 1975-1982.

1975 = 100 **(Number code in parentheses identifies category as outlined in table VII-3.)**

Fiscal year	Teacher aides and paraprofessionals				Teacher aides and paraprofessionals total index[1] (2.1)
	Instructional		Noninstructional		
	Hourly rate	Index	Hourly rate	Index	
1975	$2.91	100.0	$2.81	100.0	100.0
1976	3.12	107.2	2.92	103.9	106.2
1977	3.26	112.0	3.15	112.1	112.0
1978	3.51	120.6	3.34	118.9	120.1
1979	3.77	129.6	3.57	127.0	128.8
1980	4.06	139.5	3.89	138.4	139.2
1981	4.48	154.0	4.29	152.7	153.6
1982	4.88	167.7	4.70	167.3	167.6

[1]Teacher aides and paraprofessionals index based on weighted average as follows: instructional, 70 percent; and noninstructional, 30 percent. Weights based on ERS data.

Source: Educational Research Service, Inc., *Salaries Paid Support Personnel in Public Schools*, volumes covering 1975-1982.

laborers from BLS Employment Cost Index data. This category includes gardeners and grounds keepers, garbage collectors, vehicle washers, material handlers, carpenter helpers, etc.

4.2 Travel

The price series for travel is based on the travel reimbursement allowance provided state employees for use of a private vehicle on state business. A simple state average has been calculated. The travel reimbursement mileage rates are provided by the Assembly of Governmental Employees.

Travel by other means to out-of-district conferences and similar functions is estimated based on a survey of local schools at 10 percent of the travel budget. This component is priced by the CPI price series for public transportation that represents fares for local transit, taxicab, railroad (coach), airplane (chiefly coach), and intercity bus.

Table VII-9

Indexes and salaries for secretaries and clerical personnel of public primary and secondary schools, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category as outlined in table VII-3.)

Fiscal year	Secretaries/ stenographers		Central office Accounting/ payroll personnel		Clerk-typists	
	Salary	Index	Salary	Index	Salary	Index
1975	$ 7,318	100.0	$ 7,588	100.0	$ 6,089	100.0
1976	7,929	108.3	8,088	106.6	6,593	108.3
1977	8,446	115.4	8,613	113.5	6,934	113.9
1978	9,023	123.3	9,190	121.0	7,397	121.5
1979	9,553	130.5	9,744	128.4	7,863	129.1
1980	10,331	141.2	10,479	138.1	8,359	137.3
1981	11,568	158.1	11,688	154.0	9,350	153.6
1982	12,718	173.8	12,720	167.6	10,314	169.4

School building level				Secretaries and clerical personnel total index[1] (2.2)
Secretaries/ stenographers		Library clerks		
Salary	Index	Salary	Index	
$ 6,046	100.0	$5,052	100.0	100.0
6,521	107.9	5,333	105.6	107.7
6,849	113.3	5,668	112.2	113.6
7,328	121.2	5,970	118.2	121.3
7,772	128.5	6,449	127.7	128.8
8,348	138.1	6,778	134.2	138.2
9,357	154.8	7,573	149.9	154.7
10,301	170.4	8,272	163.7	170.1

[1]Secretaries and clerical personnel index based on weighted average as follows: central office secretaries/stenographers, 16.8 percent; central office accounting/payroll personnel, 6.2 percent; central office clerk-typists, 10.0 percent; school building level secretaries/stenographers, 57.6 percent; and library clerks, 9.4 percent. ERS data.

Source: Educational Research Service, Inc., *Salaries Paid Support Personnel in Public Schools*, volumes covering 1975-1982.

Table VII-10

Estimate of teacher fringe benefits from public higher education faculty salary and benefit data, fiscal years 1975-1982.

1975 = 100

Fiscal year	Public higher education: Average faculty salary[1] Amount (1)	Faculty fringe benefits[1] Amount (2)	Benefits as a percentage of salary (2)/(1) Actual ratio (3)	Smooth[2] curve (4)	Public elementary-secondary education: Classroom teacher salaries Amount[4] (5)	Estimated teacher fringe benefits (5) × (4) Amount (6)	Index (3.0) (7)
1975....	$15,660	$1,880	12.01%	11.5%[3]	$11,507	$1,323	100.0
1976....	17,130	2,010	11.73	12.5	12,437	1,555	117.5
1977....	18,280	2,740	14.99	13.8	13,119	1,810	136.8
1978....	19,290	2,950	15.29	15.1	13,041	1,969	148.8
1979....	20,520	3,630	17.69	16.3	14,899	2,429	183.6
1980....	22,130	3,860	17.44	17.4	15,913	2,769	209.3
1981....	24,150	4,410	18.26	18.2	17,678	3,217	243.2
1982....	26,230	5,050	19.25	19.2	19,275	3,701	279.7

[1]Salary and fringe benefits for all faculty ranks for all public institutions except AAUP category IV. Source: American Association of University Professors, *Annual Report on the Economic Status of the Profession.*

[2]Smooth curve of percentage is used to establish *general trend* in relationship of benefits to salaries for transfer to elementary-secondary education.

[3]This percent corresponds to the 11.74 percent ratio of fringe benefits to salaries obtained from National Center for Education Statistics data for public elementary-secondary schools in FY 1974.

[4]Classroom teacher salaries from table VII-4.

4.3 Printing and duplication

Printing and duplication activities at elementary-secondary schools vary from school to school, and no national average budget data are available for this activity. Large-scale jobs and formal work such as graduation programs are usually contracted with outside printers. In-house copying and duplicating by ditto, mimeograph, offset, and xerographics are generally performed by the school staff as part of their normal duties. The equipment is usually owned by the school, although some drycopy equipment may be rented. Associated costs for salaries and power usually cannot be isolated and generally are not included in

Table VII-11

Indexes of contracted services, fiscal years 1975-1982.

1975 = 100 **(Number code in parentheses identifies category as outlined in table VII-3.)**

Fiscal year	Plant operation and maintenance (4.1)	Travel			Printing and duplication (4.3)	Communication		
		Mileage	Public transportation	Total[1] (4.2)		Telephone	Postal	Total[2] (4.4)
1975	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1976	107.6	103.5	111.4	104.3	101.7	104.2	112.5	105.4
1977	115.9	107.3	118.2	108.4	104.7	106.6	128.7	109.9
1978	124.7	112.8	123.0	113.8	108.6	107.8	130.8	111.3
1979	135.8	116.6	126.4	117.6	100.8	108.2	146.6	114.0
1980	148.1	132.6	146.6	134.0	110.2	108.6	146.8	114.3
1981	162.2	146.1	186.6	150.2	119.4	114.4	154.8	120.5
1982	175.1	158.2	221.4	164.5	125.9	127.4	186.9	136.3

Contracted student transportation (4.5)	Data processing (4.6)	Consultants (4.7)	Teacher education (4.8)	Services total[3] (4.0)	Fiscal year
100.0	100.0	100.0	100.0	100.0	 1975
110.3	107.4	106.5	108.1	106.9	 1976
121.2	111.2	113.3	117.2	113.8	 1977
133.6	119.4	123.7	126.8	121.4	 1978
144.1	131.5	134.3	136.3	127.9	 1979
160.5	142.1	141.4	147.3	138.5	 1980
183.5	157.2	155.8	164.3	153.3	 1981
207.8	186.0	172.6	186.1	169.2	 1982

[1]Weighted average: mileage, 90 percent; public transportation, 10 percent.

[2]Weighted average: telephone, 85 percent; postal, 15 percent.

[3]Weighted average: plant operation and maintenance, 17.9 percent; travel, 7.2 percent; printing and duplication, 12.5 percent; communication, 18.3 percent; contracted student transportation, 26.5 percent; data processing, 8.4 percent; consultants, 5.6 percent; and teacher education, 3.6 percent.

Sources: See text under respective categories.

schools' printing and duplicating budgets. Therefore, operating costs are essentially for equipment rental and paper, although much paper used for copying is budgeted as part of supplies and equipment for administration and instruction.

Based on a limited NIE survey of local school systems, the printing and duplication budget is estimated as follows: outside contracted printing services, 30 percent; in-house printing, 70 percent. Based on a 1973 survey by the Printing Industry of America, paper and worker payroll for contracted printing are in the ratio of 2 to 3. Paper is estimated to be 30 percent of the in-house printing costs, and the remaining 70 percent is for drycopy equipment rental. Machines for large duplicating jobs account for 85 percent of equipment rental, with the remaining 15 percent for smaller machines used for limited copying.

The price series indexes for printing and duplication are presented in table VII-12. The footnotes identify the items prices, the weighted average percentages, and the sources of data.

4.4 Communication

This subindex is a fixed weight average of the Bureau of Labor Statistics' Consumer Price Index series for residential telephone service and postal charges. The weights, estimated based on a small survey of school districts and the 1972-73 Consumer Expenditure Survey, are 85 percent for telephone service and 15 percent for postal.

4.5 Contracted student transportation

Some schools contract with private firms to transport pupils to and from school at public expense, and there is no price series for the unit cost of this contracted service. As a proxy, the CPI price series for intercity bus fare is used as representative of the nationwide average cost to the consumer of urban bus transportation. Although the CPI bus fare price series does not include a profit component as would the fare price of private businesses, the weight attached to profit is probably small compared to the larger budget proportions spent on driver salaries, vehicle operation and maintenance, and vehicle purchase. The prices for these more important components should be similar in the private sector to those incurred by city transit authorities and reported in the CPI bus fare.

4.6 Data processing

Most data processing at elementary-secondary schools is performed in-house with staff personnel using micro-computers. The salaries for these staff are priced as part of subcomponent 1.1, superintendents and other administrative and professional staff (see table VII-5). Any contracted

Table VII-12

Indexes for printing and duplicating, fiscal years 1975-1982.

1975 = 100

Fiscal year	In-house printing				Contracted printing			Printing total[8] (4.3)
	Paper[1]	Equipment rental Copy[2]	Duplicating[3]	Total[4]	Paper[5]	Payroll[6]	Total[7]	
1975	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1976	104.0	100.0	100.0	101.2	95.3	107.6	102.7	101.7
1977	106.8	105.4	100.0	102.6	101.0	115.2	109.5	104.7
1978	111.6	112.3	100.0	104.8	107.8	123.8	117.4	108.6
1979	120.4	114.0	70.1	89.6	121.7	130.6	127.0	100.8
1980	133.9	121.3	74.9	97.2	140.4	140.6	140.5	110.2
1981	147.1	132.4	80.5	105.7	149.4	152.7	151.4	119.4
1982	156.1	95.5	87.9	109.1	166.8	164.1	165.2	125.9

[1]Unwater-marked bond, No. 4, 0813-0131. Producer Price Index Series.

[2]Monthly rental rate of Xerox Model 3100. Minimum charge plus meter charge beyond copy allowance for 4,000 total copies.

[3]Monthly rental rate of Xerox Model 2400. Based on 1,530 runs, 51,000 copies.

[4]Weighted average based on estimates from Xerox Corporation: paper, 30 percent; copy machine rental, 10 percent; duplicating machine rental, 60 percent.

[5]Book paper #3 uncoated offset, 0813-0122. Producer Price Index Series.

[6]Average weekly earnings of production or nonsupervisory workers in the printing and publishing industry. Bureau of Labor Statistics, *Employment and Earning* series.

[7]Weighted average: paper, 40 percent; payroll, 60 percent.

[8]Weighted average: in-house printing, 70 percent; contracted printing services, 30 percent. Based on an NIE survey of local schools.

data processing is primarily for repeat requirements such as payroll and student grade reports.

The costs associated with data processing services generally recognized within the industry are as follows: salaries, 50 percent; equipment maintenance, depreciation, and operation, 25 percent; and overhead, 25 percent. According to one industry spokesperson, customer charges are set roughly equal to 2½ times salaries, with resulting sales revenues equaling one part for labor, one part for benefits, support, and overhead, and one-half part for profit.

Whether based on costs or on the 2½ times formula, customer charges depend primarily on employee salaries. Some advances in computer technology may be passed on to the customer in the form of lower rates

for a fixed job, but this is difficult to determine. If rates were reduced owing to more efficient operations, the overall workload would have to be increased to maintain profits. And firms evidently do not make assumptions regarding the impact of computer hardware capability and workload on price.

Although salaries appear to be the dominant factor in establishing customer charges, the exclusive use here of salaries for pricing contracted computer services should be recognized as a simplification. However, pricing the industry's operations for a fixed data processing job is well beyond the scope or requirements of this price index compilation. The salaries used for data processing personnel are reported by the periodical *Infosystems*. In 1980, the reported nationwide annual survey reflected the salaries of 15,000 electronic data processing (EDP) employees in over 1,200 installations in major metropolitan areas. For the SPI, a fixed weight composite average weekly salary was calculated for 20 EDP job classifications consistently reported since 1975. The jobs include managers and supervisors, computer systems analysts, programmers, computer operators, and keypunch and tape operators.

4.7 Consultants

Elementary-secondary schools hire consultants to provide professional/technical advice and assistance. Schools most frequently seek outside services in legal matters and in matters of management and personnel administration. Salary data for consultants as a specialized field are not available. As a proxy, a composite index of salaries for attorneys, directors of personnel, and accountants is used based on the Bureau of Labor Statistics' annual *National Survey of Professional, Administrative, Technical, and Clerical Pay*.

4.8 Teacher education

This subindex is based on the Consumer Price Index series for college tuition. The CPI series represents tuition and recurring fees (e.g., health fees), with fixed weight proportions given to resident and nonresident status, public and private sector, graduate and undergraduate level, part- and full-time attendance, and type of institution.

5.0 Supplies and materials

A supply item is any article or material that meets any one or more of the following conditions: (1) it is consumed in use; (2) it loses its original shape or appearance with use; (3) it is expendable, that is, when worn out, it is replaced rather than repaired; (4) it is inexpensive and therefore not necessary to capitalize; and (5) it loses its identity through incorporation into a different or more complex unit or substance.

Supplies and materials purchased by elementary-secondary schools for current operations are organized into eight broad functional categories: instruction, administrative and secretarial, plant operation, student transportation, health, food, food service, and plant maintenance. These categories are weighted according to the national budget for elementary-secondary schools for 1974-75 as shown in the table below. Within the categories, the objects are weighted according to their relative importance in the Producer Price Index or the Consumer Price Index. Items have been priced using price series from the PPI when possible. In some instances, the CPI price series has been used when it is more relevant to or provides more comprehensive coverage of the category involved than does the PPI. The price series for supplies and materials is presented in table VII-13.

Supplies and materials category	PPI (CPI) commodity price series (percent weight)
5.1 *Instructional* (25.0 percent)	Paper, form bond 12 lb. 0913-0133 (47%) Pens and pencils 1595 (3%) Office supplies 0915-05 (18%) Magnetic tape 1178-25 (47%) Industrial chemicals 061 (3%) Sporting equipment 1512 (16%) Workbooks (9%)*
5.2 *Administrative and secretarial* (19.2 percent)	Paper, bond, 25 pct. cotton fiber 0913-0141 (68%) Pens and pencils 1595 (5%) Office supplies 0915-05 (27%)
5.3 *Plant operation* (7.2 percent)	Soaps and detergents (CPI) (24%) Other laundry and cleaning products (CPI) (19%) Cleansing and toilet tissue, paper towels, and napkins (CPI) (19%) Miscellaneous household products (CPI) (20%) Lawn and garden supplies (CPI) (18%)

*Workbooks price series from *Trends in Textbook Markets*, Paine Webber Mitchell & Hutchins, Inc.

Supplies and materials category	PPI (CPI) commodity price series (percent weight)
5.4 *Student transportation* (8.7 percent)	Gasoline unleaded 0571-0403 (72%) Motor oil 0576-010 (2%) Tires, truck 0712-0105 (17%) Storage battery 1179-0102 (4%) Auto electrical equipment 1179-06 (5%)
5.5 *Health* (1.3 percent)	Medical care commodities (CPI)
5.6 *Food* (24.6 percent)	Finished consumer food (PPI)
5.7 *Food services* (5.8 percent)	Tableware, serving pieces, and non-electric hardware (CPI) (40%) Paper cups 0915-0333 (39%) Paper plates 0915-0335 (11%) Napkins institutional 0915-0107 (10%)
5.8 *Plant maintenance* (8.2 percent)	Maintenance and repair commodities (CPI)

6.0 Equipment replacement

Equipment consists of instruments, machines, apparatus, and sets of articles that retain their original shape and appearance with use and are nonexpendable; that is, if they are damaged, it is usually more feasible to repair the article than to replace it with an entirely new unit. Further, equipment usually represents an investment of money that makes it feasible and advisable to capitalize the item. Expenditures for equipment so defined are part of a school's capital outlay or plant fund budget; however, *replacement* of equipment is considered a "current operations" expenditure.

The equipment replacement category is organized into two components—replacement of student transportation vehicles, and replacement of plant equipment. The price series is presented in table VII-14.*

*Certain small, relatively inexpensive items, usually costing less than $50, such as hand calculators, taperecorders, etc., are generally purchased with current operating funds as part of the supplies and materials budget. These items, while having the outward appearance of equipment, are sufficiently inexpensive that they are considered to be supply items rather than capital investments with a depreciation schedule.

Table VII-13

Indexes of supplies and materials, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category outlined in table VII-3.)

Fiscal year	Instructional (5.1)	Administrative and secretarial (5.2)	Plant operation (5.3)	Student transportation (5.4)	Health (5.5)
1975	100.0	100.0	100.0	100.0	100.0
1976	109.6	106.4	113.9	112.6	107.2
1977	114.9	110.8	122.1	121.5	113.9
1978	121.2	115.6	130.5	128.6	121.5
1979	133.0	123.8	141.2	153.1	130.2
1980	148.7	138.0	154.8	214.0	141.0
1981	164.7	151.8	171.2	272.8	155.3
1982	175.9	162.8	186.6	282.1	171.7

Food (5.6)	Food services (5.7)	Plant maintenance (5.8)	Supplies and materials total[1] (5.0)	Fiscal year
100.0	100.0	100.0	100.0	1975
103.9	109.4	105.3	107.8	1976
106.4	114.2	111.4	112.8	1977
114.1	119.3	118.4	119.4	1978
124.5	130.0	126.9	130.8	1979
133.9	146.3	139.3	148.1	1980
141.7	163.2	152.2	165.2	1981
147.8	176.8	161.7	175.2	1982

[1]Weighted average: instructional, 25.0 percent; administrative and secretarial, 19.2 percent; plant operation, 7.2 percent; student transportation, 8.7 percent; health, 1.3 percent; food, 24.8 percent; food services, 5.8 percent; plant maintenance, 8.2 percent.

6.1 Replacement of student transportation vehicles

The primary vehicles for student transportation are buses. The price series used in index compilation is the Producer Price Index component #141103, motor coaches.

Table VII-14

Indexes of equipment replacement, fiscal years 1975-1982.

1975 = 100 (Number code in parentheses identifies category outlined in table VII-3.)

Fiscal year	Student transportation vehicles (6.1)	Plant equipment: Heating	Plant equipment: Central air conditioning	Plant equipment: Unitary air conditioning	Plant equipment: Furniture	Plant equipment: Vitreous china fixtures	Plant equipment: Index[1] (6.2)	Equipment index[2] (6.0)
1975....	100.0	100.0	—	—	100.0	100.0	100.0	100.0
1976....	113.6	108.0	—	—	102.5	108.6	107.2	109.6
1977....	120.8	113.2	—	—	106.4	118.4	113.1	115.9
1978....	130.7	119.0	120.5	120.5	117.9	129.4	120.5	124.3
1979....	143.1	126.5	132.2	129.8	128.9	141.3	129.4	134.5
1980....	159.0	137.7	148.1	140.7	138.0	157.5	141.7	148.1
1981....	178.9	150.7	162.0	151.2	149.6	174.6	155.0	163.8
1982....	198.0	162.1	170.5	159.8	162.1	185.9	166.8	177.7

[1]Weighted average: heating, 55 percent; central air conditioning, 20 percent; unitary air conditioning, 4 percent; furniture, 12 percent; china fixtures, 9 percent. PPI weights with unitary air conditioning adjusted downward.

[2]Weighted average: student transportation vehicles, 37 percent; plant equipment, 63 percent (from table VII-3).

From 1979 through 1982, fewer than three firms reported motor coach prices to the Bureau of Labor Statistics, which creates a confidentiality problem with regard to this component. Thus, for this period, the price series for heavy trucks, #141102-81, has been substituted and linked in 1979. BLS expects to resume the motor coach series in 1983.

6.2 Replacement of plant equipment

Plant equipment consists of major items of permanent equipment usually integrated into a structure and built in during initial construction, such as the heating and cooling system, plumbing, electrical system, and elevators and escalators. For schools, the plant equipment priced consists of the following Producer Price Index components: heating equipment 106, central air conditioning 1148-01, unitary air conditioning 1148-02, furniture 122, and vitreous china fixtures 1052. Although not permanent equipment, unitary air conditioners serve as a substitute for central air conditioning and are included on that basis.

7.0 Books, periodicals, and audiovisual

This index and its components, presented in table VII-15, are a fixed weight average of the price series for library materials (43.8 percent) and free textbooks to students (56.2 percent). Considerable price data are available for the types of purchases made by school libraries. This amount of detail, while not necessary for the accuracy of the overall School Price Index, is particularly useful for librarians in analyzing the effects of inflation on past and future acquisition budgets. Further identification of items priced, weights assigned, and sources is provided in the footnotes.

8.0 Utilities

This subindex is a composite of the Producer Price Index series for natural gas (BLS No. 0531), fuel oil #2 to resellers (BLS No. 0573-0201), commercial electrical power (BLS No. 0542), and water and sewerage services (CPI). A trash collection category is being added to the CPI but will not be available for 2 to 3 years. In the interim, wages for nonfarm laborers from the U.S. Department of Labor Employment Cost Index (ECI), which includes garbage collectors, is used as a proxy.

The utility components are weighted according to the national average elementary-secondary school 1974-75 budget shown in table VII-3. The Price series for utilities is shown in table VII-16.

9.0 Fixed costs

This category includes charges of a generally recurrent nature that are not readily allocated to other expenditure categories. The three components of fixed charges are insurance, rents and leases, and "other," which includes school board contributions to employee retirement.

There is no suitable price information available for commercial insurance or rents. As a substitute, the CPI price series for residential property insurance and for residential rent is used. The "other" category is priced by the employee fringe benefit index (3.0) from table VII-10. The fixed costs components are weighted according to the national average budget, table VII-3. The price series for fixed costs is shown in table VII-16.

Table VII-15

Average prices and indexes for library materials and textbooks, fiscal years 1975-1982.

1975 = 100

Year		Hardcover books				
		Elementary		Secondary		
Calendar	Fiscal	Avg[1] price	Index	Avg[2] price	Index	Index[3]
1974	1975	$5.01	100.0	$14.09	100.0	100.0
1975	1976	5.82	116.2	16.19	114.9	115.6
1976	1977	5.87	117.2	17.20	122.1	119.5
1977	1978	6.64	132.5	18.03	128.0	130.4
1978	1979	6.59	131.5	20.10	142.7	136.8
1979	1980	7.13	142.3	22.80	161.8	151.5
1980	1981	8.21	163.9	23.57	167.3	165.5
1981	1982	8.29	165.5	25.48	180.8	172.7

*Estimates.

[1]Juvenile book category (age 8 or younger, fiction).

[2]All book categories.

[3]Weighted average: elementary (K-8) books, 53 percent; secondary (7-12) books, 47 percent. Weights based on data reported in the National Center for Education Statistics' *Statistics of Public School Library Media Centers*, 1973-74 survey.

[4]Children's periodicals (76 titles in 1982).

[5]General interest periodicals (176 titles in 1982).

[6]Weighted average: elementary (K-8) periodicals, 42 percent; secondary (7-12) periodicals, 58 percent. Weights based on data reported in the National Center for Education Statistics' *Statistics of Public School Library Media Centers*, 1973-74 survey.

[7]Average price per foot, 35-mm positive microfilm.

[8]Average cost per minute, color purchase.

[9]Average cost of filmstrip set (cassette).

[10]Weighted average: 16-mm film, 31.4 percent; video cassettes, 0.8 percent; filmstrips, 32.5 percent; prerecorded tapes, 9.6 percent; multimedia kits, 25.9 percent. Based on industry sales data from *Survey of 1975 Educational Media Sales*, Association of Media Producers, Washington, D.C.

[11]Weighted average: hardcover books, 56 percent; paperback books, 3 percent; periodicals, 9 percent; microfilm, 2 percent; audiovisual materials, 30 percent. Weights based on data reported in the National Center for Education Statistics' *Statistics of Public School Library Media Centers*, 1973-74 survey.

Mass market paperback books				
Elementary		Secondary		
Avg[1] price	Index	Avg[2] price	Index	Index[3]
$ .98	100.0	$1.28	100.0	100.0
1.07	109.2	1.46	114.1	111.5
1.22	124.5	1.60	125.0	124.7
1.41	143.9	1.71	133.6	139.1
1.47	150.0	1.91	149.2	149.6
1.48	151.0	2.06	160.9	155.7
1.65*	168.4	2.50	195.3	181.0
1.79	182.7	2.65	207.0	194.1

[12]Weighted average: hardbound textbooks, 81 percent; softbound textbooks, 19 percent. Weights based on data for 1974 reported in *Trends in Textbook Markets—Status Report*, Paine Webber Mitchell & Hutchins, Inc., New York.

[13]Weighted average: library materials, 43.8 percent; textbooks, 56.2 percent. Weights from table VII-3.

Sources: Prices of hardcover books and mass market paperback books are based on books listed in the *Weekly Record* for the calendar year with an imprint for the *same* year (usually cited as *preliminary* data). Not included are mass market paperbacks, government documents, and certain multivolume encyclopedias. Published in *The Bowker Annual of Library and Book Trade Information*, R.R. Bowker, New York.

Prices of microfilm compiled by Imre T. Jarmy from the *Directory of Library Reprographic Services: A World Guide* and supplemental data. Published in *The Bowker Annual of Library and Book Trade Information*, R.R. Bowker, New York.

Prices of audiovisual materials compiled by David B. Walch based on information derived from selected issues of *Previews and Booklists*. Published in *The Bowker Annual of Library and Book Trade Information*, R.R. Bowker, New York.

Prices of hardbound and softbound textbooks from J. Kendrick Noble, Jr., *Trends in Textbook Markets—Status Report*, prepared for the Book Industry Study Group, Inc., published by Paine Webber Mitchell & Hutchins, Inc., New York.

Table VII-15 (Cont)

Average prices and indexes for library materials and textbooks, fiscal years 1975-1982.

1975 = 100

Year		U.S. periodicals					Microfilm	
		Elementary		Secondary				
Calendar	Fiscal	Avg[4] price	Index	Avg[5] price	Index	Index[6]	Avg[7] price	Index
1974	1975	$3.72	100.0	$11.43	100.0	100.0	$.1060*	100.0
1975	1976	4.69	126.1	14.36	125.6	125.8	.1190	106.0
1976	1977	5.32	143.0	15.24	133.3	137.4	.1335*	125.9
1977	1978	5.82	156.5	16.19	141.6	147.9	.1475*	139.2
1978	1979	6.34	170.4	17.26	151.0	159.1	.1612	152.1
1979	1980	6.70	180.1	18.28	159.9	168.4	.1750*	165.1
1980	1981	7.85	211.0	19.87	173.8	189.4	.1890*	178.3
1981	1982	8.56	230.1	21.83	191.0	207.4	.2021	190.7

Audiovisual materials (cont.)

Year		Prerecorded cassette tape		Multimedia kits		
Calendar	Fiscal	Avg price	Index	Avg price	Index	Index[10]
1974	1975	$10.76	100.0	$100.00	100.0	100.0
1975	1976	10.32	95.9	140.25	140.3	118.9
1976	1977	12.08	112.3	93.63	93.6	100.5
1977	1978	10.63	98.8	93.65	93.7	111.2
1978	1979	12.57	116.8	117.38	117.4	108.2
1979	1980	12.58	116.9	85.70	85.7	104.7
1980	1981	9.34	86.8	92.71	92.7	100.0
1981	1982	12.48	116.0	46.99	47.0	104.5

Audiovisual materials					
16-mm film		Video cassettes		Filmstrip	
Avg price[8]	Index	Avg price	Index	Avg price[9]	Index
$11.55	100.0	—	—	$63.76	100.0
12.85	111.3	—	—	73.91	115.9
12.93	111.9	—	—	58.41	91.6
13.95	120.8	—	—	76.26	119.6
12.56	108.7	—	—	62.31	97.7
13.62	117.9	—	—	65.97	103.5
12.03	104.2	$ 7.58	100.0	67.39	105.7
16.09	139.3	14.87	196.2	71.12	111.5

Free textbooks to students						
Library materials Index[11]	Hardbound Avg price	Index	Paperbound Avg price	Index	Index[12]	Library materials and textbooks[13] Index
100.0	$4.01	100.0	$1.61	100.0	100.0	100.0
117.2	4.25	106.0	1.97	122.4	109.1	112.6
115.7	4.50	112.2	2.21	137.3	117.0	116.4
123.9	4.76	118.7	2.32	144.1	123.5	123.7
130.9	5.14	128.2	2.39	148.4	132.0	131.5
139.4	5.32	132.7	2.47	153.4	136.6	137.8
148.7	5.67	141.4	2.76	171.4	147.1	147.8
156.4	6.24*	155.6	3.12	193.8	162.9	160.1

Table VII-16

Indexes of utilities and fixed costs, fiscal years 1975-1982.

1975 = 100 **(Number code in parentheses identifies category as outlined in table VII-3.)**

Fiscal year	Utilities					
	Fuel oil (8.1)	Electrical power (8.2)	Natural gas (8.3)	Water and sewerage (8.4)	Trash collection (8.5)	Utility index[1] (8.0)
1975	100.0	100.0	100.0	100.0	100.0	100.0
1976	111.3	110.4	137.0	110.4	108.0	111.1
1977	124.6	120.0	190.0	122.5	116.0	123.3
1978	135.7	130.2	243.2	136.0	125.6	134.7
1979	169.1	138.6	304.1	146.6	135.5	156.4
1980	246.7	155.3	400.9	154.9	149.2	203.9
1981	331.3	179.1	525.4	169.6	162.4	258.3
1982	359.6	201.2	650.0	191.1	173.4	284.6

Fixed Costs				
Insurance (9.1)	Rents (9.2)	Other[2] (9.3)	Fixed cost index[3] (9.0)	Fiscal year
100.0	100.0	100.0	100.0	1975
112.4	105.2	117.5	112.8	1976
126.8	111.3	136.8	127.5	1977
143.0	118.5	148.8	142.4	1978
157.4	126.9	183.6	159.9	1979
175.2	137.2	209.3	178.6	1980
195.1	149.2	243.2	200.3	1981
208.9	161.4	279.7	218.0	1982

[1]Weighted average: heating fuel oil, 49.4 percent; electrical power, 40.0 percent; natural gas, 1.5 percent; water and sewerage, 5.1 percent; trash collection, 4.0 percent (from table VII-3).

[2]Primarily school board contributions to employee retirement, table VII-10.

[3]Weighted average: insurance, 76.0 percent; rents, 6.7 percent; other, 17.3 percent (from table VII-3).

APPENDIX A. ECONOMIES OF SCALE AND MARGINAL COST ANALYSIS

State legislators and other major sources of funding for higher education have expressed great interest in the marginal cost concept as applied to colleges and universities. State officials, recognizing the principle of economy of scale, expect that the cost of educating "additional students" will be less than the average cost for each student. However, the size of economies of scale and the exact difference between marginal and average costs are difficult to determine.

This appendix combines theory and empirical evidence in an attempt to illuminate how costs relate to student enrollment. A theoretical model, based on the production curve of 17 California state colleges, is presented for estimating the decline in average costs for expected enrollment growth.

Economies of Scale

Economy of scale is the decline in the unit cost of production that occurs as the output and size of operations increase. This economy derives from certain fixed costs that remain relatively constant regardless of the amount of output produced; thus, they progressively become smaller on a unit-of-production basis.

For colleges and universities, for example, fixed costs include the land and buildings of a campus, which must be amortized over their expected life. Additionally, certain functions—general administration, library, and plant maintenance, for example—do not increase in proportion to enrollments: a college, no matter how small or large, normally employs one president, one chief librarian, one dean of students, and so on. Further, a minimum academic program is required for any initial enrollment. Some authorities say that the faculty must number at least 60 to cover most of the educational disciplines in a liberal arts college. The need for such a core staff imposes a major burden on small colleges.

As colleges increase enrollments, these relatively fixed costs are distributed over more and more students, thus reducing average cost per student. This reduction initially is sharp but becomes more gradual with further expansion. Some variable costs also contribute to economies of scale. For example, having a greater number of students increases the

chances for small colleges to fill previously half-filled classes, thereby improving efficiency of instruction. The economies of scale resulting from fixed costs and some reduction in variable costs produce the classical declining average cost curve.

Being "too small" and struggling for improved efficiency through expansion is a common phenomenon for most colleges. There is another side to the coin, however. As institutions grow larger, the number of courses and services offered to students increases. The size of the administrative staff also increases, so that the budget for administration eventually may grow faster than enrollment. When increased size does not improve efficiency, the average cost per student increases and diseconomies of scale exist. However, this situation is rare, and the level of inefficiency initially introduced is very small.

It is difficult to find empirical proof of the relationship between per student costs and enrollment size, or the "production curve" for colleges. To determine valid decreasing unit costs, it is essential that all the variously sized colleges be similar except for size. That is, the quality and diversity of programs offered must be comparable in terms of institutional mission and basic curriculum, teacher salary schedules, principles for class size determination, provision of student services, and so on. Yet few institutions of different sizes are equal in these respects. And student costs over time for a single institution usually are not comparable because of the many changes a college makes in its programs and operations as it grows.

One case appears close to fulfilling the comparability requirements. In 1969, the California Coordinating Council collected operating cost data from 17 California state colleges having enrollments of less than 1,000 FTE students to over 16,000 FTE students.[1] The plot of average operating costs per FTE student, excluding debt amortization, for the 17 colleges is shown in the upper right corner of figure A-1. The colleges had received detailed guidance from the Council regarding many aspects of operations, resulting in the general use of many standard rules for program expansion, staffing, student-faculty ratios, class size, salaries, and the like. These practices established comparable quality, with enrollment becoming the principal differential feature. The California data thus present perhaps a once-in-a-lifetime opportunity to study economies of scale. If one valid, long-run average cost curve can be plotted from empirical data, it could be used to establish the *theoretical shape* (i.e., the slope or rate of change of the curve at various enrollments) of a production curve that possibly is applicable to other similar public 4-year institutions.

Is the shape of the California college cost curve relevant to other institutions? The curve, shown in the upper right portion of figure A-1, is

[1]California Coordinating Council for Higher Education, *Meeting the Enrollment Demand for Public Higher Education in California Through 1977—The Need for Additional Colleges and University Campuses*, CCHE, Sacramento, 1969 Appendix D-1.

the classical cost curve, sloping downward at a diminishing rate. It can be argued that the same common forces creating economies of scale in the California system act in all institutions of higher education. Further, the California colleges probably changed their student-faculty ratios, class sizes, and so on in a reasonable manner as they grew, attempting in each instance to realize whatever gains in operating efficiency were possible from the additional students. To experience a similarly sloped cost curve, other institutions would have to operate at or near maximum efficiency, plan future growth at the same level of efficiency, and maintain their present mission, academic program, student services, and the like consistent with the development pattern of the California colleges.

It is not justifiable to assume that other institutions will experience production curves similar to those of the California colleges without considerable study beyond this limited presentation. Nevertheless, in the discussion that follows, this assumption is tentatively accepted in order to support certain observations and recommendations believed to be of value for many public 4-year colleges. Some economic theory has been introduced to provide a more complete understanding of the economies of scale phenomenon. The following discussion makes reference to the curves in figure A-1.

Production Cost Analysis

The Long-Run Cost Curve

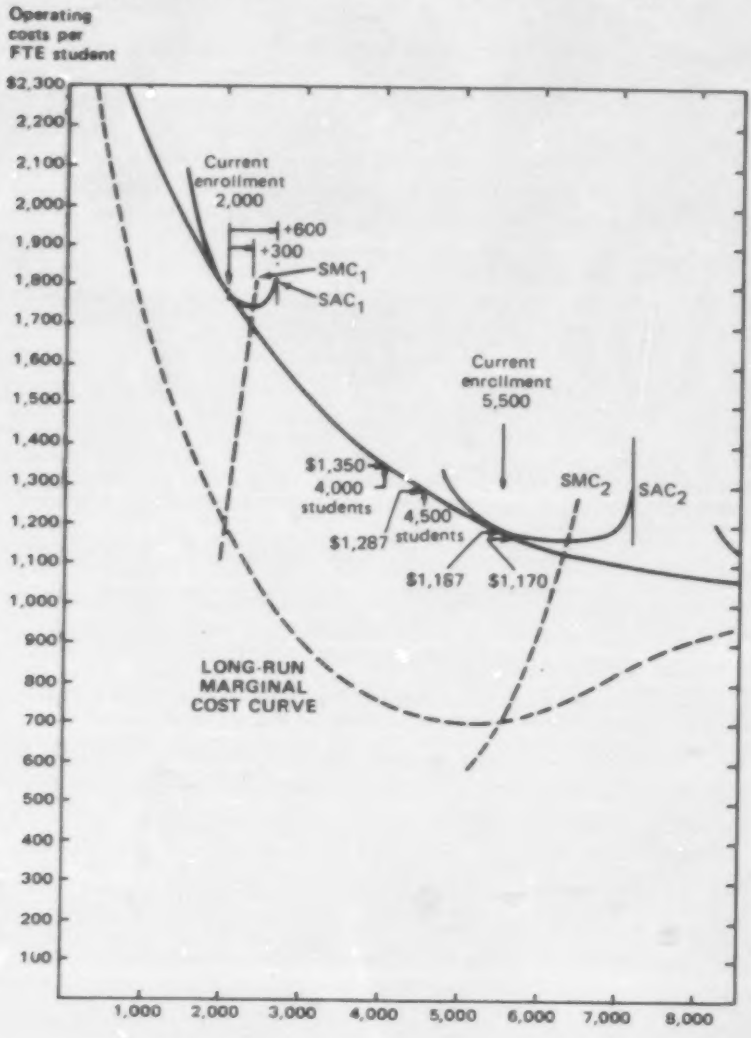
The long-run average cost (LAC) curve in higher education represents the least possible average cost per student at various enrollment or production levels when the institution has sufficient time to vary the quantities of *all* resources used—personnel, equipment, and plant. The LAC curve is derived by constructing a curve tangent to a series of short-run average cost (SAC) curves representing various scales of more restricted resource use designed to produce minimum operating costs at various enrollment levels. (SAC curves are discussed in a following section.)

For this discussion, it is assumed that each of the 17 California state colleges has a scale of resources suitable for its current (1969) enrollment and is therefore operating at or close to the LAC curve. This is a reasonable assumption based on the Council's guidance and the public demand for efficiency. A LAC curve is therefore assumed to be an envelope located slightly below the operating positions for the colleges, as illustrated on the plot within figure A-1.

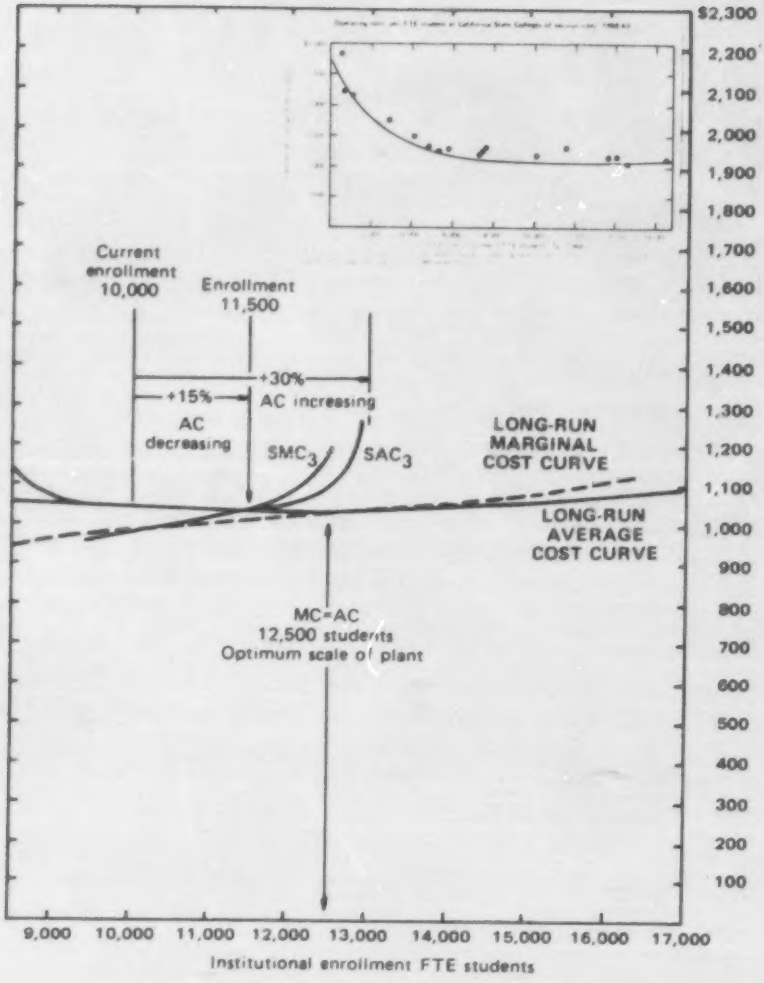
The declining LAC curve clearly shows economies of scale brought about by fixed costs and improved efficiency at greater enrollments. Extremely high costs occur at low enrollments, where the minimum staff and administrative expenses are essentially irreducible. Costs drop very rapidly as enrollment approaches 4,000 students, indicating the

Figure A-1

Theoretical production curve for public 4-year colleges for economies of scale and marginal cost analysis.



Source: California Coordinating Council for Higher Education, *Meeting the Enrollment Demand for Public Higher Education in California Through 1977*, Sacramento, 1969, appendix D.


$2,300
2,200
2,100
2,000
1,900
1,800
1,700
1,600
1,500
1,400
1,300
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
Current enrollment 10,000
Enrollment 11,500
+30%
+15%
AC increasing
AC decreasing
SMC3
SAC3
LONG-RUN MARGINAL COST CURVE
LONG-RUN AVERAGE COST CURVE
MC=AC
12,500 students
Optimum scale of plant
9,000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
Institutional enrollment FTE students

desirability of small colleges obtaining this essential growth to maintain their financial well-being. A 5,000 to 6,000 enrollment, costs per student begin to level off as fixed operating expenses are spread increasingly thinner over an increasing number of students, eventually resulting in a general flattening of the curve at approximately 9,000 students. The optimal resource scale of plant, where average costs appear to reach a minimum, is an enrollment of about 12,500 students. There is little discernible change in average cost beyond this point. The curve is so level in this area that there is no real indication of where diseconomies of scale begin. From these data, certainly any institution with enrollment beyond 9,000 has a near optimal plant size. It is possible that beyond 20,000 students some diseconomies of scale may be significant, but this should be of little concern to the majority of institutions.

The Long-Run Marginal Cost Curve

The long-run marginal cost (LMC) curve, which is based on the LAC curve, represents the increase in total cost resulting from an increase of *one* student (output), with the institution having ample time to adjust the quantities of all resources used. Because institutions operate in the short term, with a reasonably fixed amount of resources for current planned enrollment, the LMC curve has little meaning for year-to-year operations. The LMC curve is helpful, however, in indicating how an enrollment level of 8,000 to 9,000 students obtains near optimal efficiency by taking advantage of most low-marginal-cost student additions. Also, the LMC curve is helpful in constructing the short-term marginal cost (SMC) curves, which do apply to institutions on a year-to-year basis.

Short-Run Average Cost Curves

Over the long term, most colleges assemble a given amount and mix of resources necessary to conduct operations with maximum efficiency at their planned enrollment level. Their point of operation is therefore at or slightly above the long-run average cost curve, which by definition shows the least possible cost per student at various enrollments when the college has time to build to any desired institutional size. However, because colleges have a relatively fixed amount of resources for their planned enrollment, they are operating in the short run—possibly 1 to 3 years—which is not sufficient time to vary resources so as to react most efficiently to any change in enrollments. The short-run average cost (SAC) curve is therefore above the LAC at every point other than the current operating level.

Three hypothetical SAC curves are plotted. Each curve is drawn tangent to the LAC curve at the enrollment level involved. To obtain the shape of the curve, it is assumed that an institution could accommodate a relatively sudden (short-term) increase in enrollment of approximately 15 percent before average costs would start to rise. This accommodation is made by using any extra capacity of the existing plant, renting additional space as required, having present staff work overtime, hiring new and part-time faculty and administrators, and increasing class size if necessary. Beyond this 15 percent increase, average costs gradually rise at an increasing rate with the physical plant capacity, limiting maximum enrollment growth to approximately 30 percent. At this point, costs increase rapidly owing to the difficulties of hiring more faculty and obtaining additional space on short notice. Any enrollment decline from the current operating position results in a relatively rapid rate of cost increase because of the near impossibility in the short run of reducing staff and plant.

Notice that institutions can increase enrollment slightly and can lower average costs per students in the short run. But they cannot lower costs to the level of the LAC curve without revising their plan, i.e., altering all resources as required for most efficient operation at the new, larger enrollment level.

The flatter SAC curves at greater enrollments indicate that larger colleges can more easily accommodate large changes in absolute numbers of students without serious change to average costs. For small institutions, the same percentage growth adds relatively few additional students before average costs begin to rise.

Short-Run Marginal Cost Curves

The short-run marginal cost (SMC) curve represents the increase in total cost resulting from an increase of *one* student when an institution has insufficient time to change all resources. Marginal costs always equal average costs where average costs are a minimum: when average costs are decreasing, marginal costs are less than average costs; when average costs are increasing, marginal costs are greater than average costs. Also, short-run marginal costs equal long-run marginal costs at the point at which short-run and long-run average costs are equal, i.e., the two average cost curves are tangent. Thus, there are two locations for plotting the SMC curves—the point at which the SAC curves are at minimum, and the point on the LMC curve directly below the tangency of the SAC and LAC curves. The three sample SMC curves are plotted in figure A-1 dash lines.

Since marginal costs will differ with *each* additional student, it is awkward to use marginal costs in calculating new total costs for any

change in enrollments. The marginal cost curve is therefore primarily of value in understanding how the incremental cost of adding students *changes*.

Notice the steepness of the SMC curve for colleges with less than 4,000 students. For these small colleges, the costs associated with adding students beyond the planned level of enrollment initially are low, but they increase rapidly and eventually become prohibitive. For colleges with enrollments of 6,000 students or more, the SMC curve is relatively flat, indicating that the additional costs for individual students are similar to average costs for a sizable increase in enrollment.

Use of Data

For this discussion, it is assumed that the shape of the California college LAC curve is relevant for similar public 4-year institutions. This means that the rate of change or slope of the LAC at any given enrollment is applicable to other institutions regardless of the overall quality (average student costs) of their programs. Thus, a *percentage* decline in average costs shown on the LAC curve for any enrollment growth is applicable to similar public 4-year colleges. For example, a college planning a long-term growth from 4,000 students to 4,500 students might experience a decline in average student costs similar to the 4.67 percent reduction (from $1,350 to $1,287) shown on the LAC curve for these enrollment levels.

Since each college operates on its own short-run average cost curve, the SAC curve is of special importance. Each institution must construct its own SAC curve based on expected short-run institutional response to enrollment growth or decline. Actual costs on the vertical axis can be ignored temporarily since the object is to estimate the general shape of the curve.

If the institution has had a stable enrollment for some time, which permits changes in all resources involved, the SAC curve is started tangent to the LAC curve at the current enrollment. If enrollment exceeds or is less than that for which resources were planned, the point of tangency may be, respectively, to the left or the right of the current enrollment. The curve is constructed to slope gradually downward during that portion of enrollment growth (probably 15 to 25 percent) over which the institution expects average costs to decline, to level at expected minimum average costs, and to gradually slope upward beyond the optimal plant scale, finally rising sharply as plant capacity limitations set in. For a decline in enrollment, the SAC curve slopes gradually upward and then rises rapidly when operating costs cannot be reduced in proportion to student reduction. *The SAC must always be above the LAC except at the point of tangency.* The SMC curve is not necessary for the analysis.

The SAC curve constructed can be used to determine the change in average costs that might result from a change in enrollment when an institution has not had sufficient time to change all its resources. To illustrate, assume an institution currently enrolling 5,500 students constructs a SAC curve similar to that shown in figure A-1. If the institution expects 500 additional students next year, and if it cannot or does not plan to vary its scale of plant (land, buildings, equipment, and administration), then it can expect a decline in average student costs of 1.4 percent. The decline is indicated on the SAC_2 curve by the ratio (.986) of average costs per student ($1,170/$1,187) at enrollments of 6,000 and 5,500 students. If the institution's *actual* average costs were $4,300 per student, they would be lowered the estimated 1.4 percent, to $4,240. The total budget would change from $23,650,000 to $25,440,000, an increase of $1,790,000 for 500 additional students, for an *average* marginal cost per added student of $3,580.

This example illustrates how a public 4-year college can construct a SAC curve in relation to the LAC of the 17 California state colleges and can use this curve to estimate average costs for different enrollment growths over the short run. There are a number of major assumptions involved, most notably that the institution is operating near maximum efficiency for its enrollment and that its average costs, in the long run, will experience a relative decline similar to that of the California colleges. However, with so little information available on the production curves of colleges, these limited data should be of some practical value in visualizing possible savings through economies of scale and as a theoretical means of estimating budgetary increases for enrollment growth in the short run. This approach might be validated through case studies.

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